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PALM (T.). **Die Holz- und Rinden-Käfer der nordschwedischen Laubbäume.** [Beetles in the Wood and Bark of deciduous Trees in northern Sweden.]—*Medd. SkogsforsknInst.* **40** no. 2, 242 pp., 3 pls., 63 figs., 58 refs. Stockholm, 1952. (With a Summary in Swedish.)

A survey of the Coleoptera that live in the wood or bark of deciduous forest trees in northern Sweden was carried out in 1944–49, and the main results are presented in this paper. The first part contains accounts of the areas investigated, the methods adopted, the frequency of the different species, their geographical distribution, climatic and micro-climatic preferences and feeding habits, the position (whether standing or lying) and physical condition of the trees in which they were found, and their status and economic importance. Notes on the bionomics of the different families are included, and examples are quoted showing how attack by one species often conditioned a tree for further infestation by another. Lists are given of the 414 species found, and much of the data is summarised in tables. The second part is arranged systematically and comprises a list of the species with more detailed information on bionomics and habitats and description of frass, feeding galleries and other traces in cases where these are of use for identification.

BUTOVITSCH (V.). **Undersökningar över virkesförstörande insekters spridning och skadegörelse i boningshus i Blekinge län och Kalmar läns södra landstingsområde.** [Investigations on the Distribution of Wood-destroying Insects and Damage in Dwelling Houses in Blekinge and southern Kalmar.] —*Medd. SkogsforsknInst.* **40** no. 5, 39 pp., 2 figs., 7 refs. Stockholm, 1952. (With a Summary in German.)

Since the earlier surveys of wood-destroying insects in buildings in Sweden [*cf. R.A.E.*, A **40** 55, etc.] were based largely on information supplied by non-experts [*cf.* **23** 684], they were not free from error. A system of inspection of sample buildings by entomologists was therefore developed and tested in the south-eastern provinces of Blekinge and Kalmar in the autumn of 1948, when 513 dwelling houses in coastal and inland districts were examined. The following is based on the author's summary of the results. The commonest wood-destroying insects and (in brackets) the percentages of houses found infested by them were *Callidium violaceum* (L.) (73·6), *Ernobius mollis* (L.) (54), *Hylotrupes bajulus* (L.) (51·8) and *Anobium punctatum* (Deg.) (39·8). The percentage of buildings infested by *H. bajulus* was lower on the coast than inland, and increased with age in houses of up to 50 years old, above which it declined somewhat. Roof timbers were the most commonly attacked, shingle roofs being more heavily infested than others [*cf.* **29** 324]. Extensive damage was comparatively rare. No preference was shown for wood of a particular species. Over 70 per cent. of houses built wholly or partly with timber from old, demolished buildings showed damage by *H. bajulus*. The cost of control measures is discussed. *A. punctatum* was found mainly in timbers in cellars, and infestation again increased with the age of the house. It was much commoner than *H. bajulus* in houses over 50 years old. Severe damage was again rare. *E. mollis* and *C. violaceum* occurred mainly in attics, the degree of infestation varying with the proportion of unbarked timber in the construction [*cf.* **23** 683, 684; **35** 294].

GHESQUIÈRE (J.). **Un parasite de la *Ceratitis capitata* Wied. en France.**—*Bull. Soc. ent. Fr.* **55** no. 5 pp. 66–68, 17 refs. Paris, 1950.

Ceratitis capitata (Wied.) caused severe damage to fruits near Paris and Mentone in 1949. At Mentone, the fig harvest was almost entirely destroyed

by this fruit-fly and *Lonchaea aristella* Beck. No parasites of *C. capitata* have hitherto been reported from France, and none emerged in large-scale work at Mentone, but 12 adults of the Braconid, *Aphaereta minuta* var. *cephalotes* (Hal.), were obtained from five pupae at Mantes-Gassicourt (Seine-et-Oise), a new and important centre of infestation. In experiments, females deposited 2–3 eggs in full-fed larvae of *C. capitata*, and the life-cycle lasted 22 days at a mean temperature of 22°C. [71·6°F.] so that there are probably six generations between spring and autumn in warm years and 4–5 in cold ones.

The author describes characters additional to those given by G. E. J. Nixon in a paper already noticed [*R.A.E.*, A **27** 604] differentiating the typical *A. minuta* (Nees), which parasitises carrion-infesting Diptera, and var. *cephalotes*, which attacks phytophagous Diptera [*cf.* **10** 50, 105; **11** 71]. The parasite recorded as *A. minuta* from *Hylemyia* (*Phorbia*) *brassicae* (Bch.) in Morocco [**25** 540] was actually var. *cephalotes*. The species is widely distributed in the Palaearctic region, the typical form being apparently commoner than var. *cephalotes* in France. The latter may become of some importance in controlling *C. capitata*, particularly as it probably has more generations a year than the fruit-fly.

SPEYER (E. R.). **Gladiolus Thrips** (*Taeniothrips simplex* **Mor.) in England.**—*Proc. R. ent. Soc. Lond.* (B) **20** pt. 5–6 pp. 53–62, 7 figs., 10 refs. London, 1951.

An account is given of the first recorded infestation of *Gladiolus* in England by *Taeniothrips simplex* (Morison), which was observed in north-eastern Middlesex in July 1950 [*cf. R.A.E.*, A **40** 224], and the habits, life-cycle and control of the thrips are reviewed from the literature. The corms from which the infested plants were raised had mostly been obtained from Holland four years earlier, and a similar but less severe attack had been noticed in the first flowering season; during the winter of 1949–50, the corms were stored in a heated greenhouse. By September, infestation was greatly reduced, partly by heavy rain and partly by DDT sprays, and late varieties produced good flowers. Many eggs and nymphs were then present, but there were few pupae, and it is assumed that most of the second-instar nymphs descended to the ground when fully fed. No infestation occurred on recently lifted corms of earlier varieties. Native thrips of ten species were taken in random collections from *Gladiolus* flowers in southern and northern England, but none appeared to be injurious. The two with which *T. simplex* might be confused are *T. atratus* (Hal.) and *T. vulgatissimus* (Hal.), which are common in the flowers of many plants, and characters are given distinguishing these three from one another and from other British members of the genus. The survival of *T. simplex* out of doors during the winter in Britain is considered impossible. The succession of mild winters prior to 1950 probably facilitated its survival on stored corms and enabled several generations to be produced before the earlier varieties of *Gladiolus* came into flower.

STEEL (W. O.) & HOWE (R. W.). **A new Species of** *Laemophloeus* **(Col: Cucujidae) associated with Stored Products.**—*Proc. R. ent. Soc. Lond.* (B) **21** pt. 5–6 pp. 86–88, 2 figs., 4 refs. London, 1952.

The Cucujid here described from adults of both sexes as *Laemophloeus pusilloides*, sp. n., has been reared in laboratories in southern England for several years and is the species referred to as *Laemophloeus* sp. by Lucas & Oxley [*R.A.E.*, A **36** 418] and by Finlayson [**38** 308]. It has been recorded from different parts of England since 1945 in stored products comprising wheat from Canada, England and Australia, rice from Brazil, sorghum and

flour from Australia, and crushed locust beans [*Ceratonia siliqua*] from Portugal; specimens were also received from South Africa in 1944. It is closely related to *L. minutus* (Ol.) and *L. turcicus* Grouv., and characters differentiating these three species are included.

PETTY (B. K.) & LOCHNER (E. H.). **Comparison of Fumigation, Contact and Stomach Actions of Benzene Hexachloride, D.D.T., Chlordan, Chlorinated Camphene and Parathion.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 302, 12 pp., 4 graphs, 3 refs. Pretoria [? 1950].

Since modern synthetic insecticides may act in several ways, the fumigant, contact and stomach-poison effects of dusts of DDT, BHC (benzene hexachloride), chlordan, chlorinated camphene [toxaphene] and parathion were compared in the laboratory in South Africa. The test insects were *Gonipterus scutellatus* Gylh., *Astylus atromaculatus* (Blanch.) and *Trinervitermes havilandi* Fuller, but only the first was used in the experiments on stomach poisons. The concentrations were those common in field application. Parathion was used at 2 per cent., and also at 1 per cent. in the contact tests, and the other materials at 10 per cent. as fumigants and 5 per cent. as stomach and contact poisons. Fumigant action was tested by leaving 10 gm. dust in a petri dish in a tightly closed desiccator for 48 hours and then introducing the test insects confined on moist filter paper in three open petri dishes, which were placed one above the other over the insecticide; the exposures were for 30 hours for the termite and 72 hours for the beetles. In the contact experiments the insects were confined for one hour on filter papers dusted with the insecticides at rates of 0·11 mg. per sq. cm. for the beetles and 0·06 mg. per sq. cm. for the termite; soldiers of *T. havilandi*, which feed only when accompanied by workers, were used in this test, to eliminate stomach effects. The sandwich method, with leaf disks dusted at 0·22 mg. per sq. cm., was used for the tests on stomach action. The laboratory was maintained at 75°F. and 70–75 per cent. relative humidity.

Chlordan was found to be the best fumigant against all three insects, followed, in order of decreasing effectiveness, by BHC and parathion; the greatest concentrations of their vapours occurred at the top of the desiccator. The fumigant properties of DDT and toxaphene were very poor. In the contact tests, BHC gave the most rapid knockdown of *T. havilandi* and DDT of *A. atromaculatus* and *G. scutellatus*, but when mortality was taken as the criterion, BHC and chlordan were the most effective against *T. havilandi*, chlordan against *A. atromaculatus*, and parathion, at both concentrations, and DDT against *G. scutellatus*. High mortality was also given by DDT and 2 per cent. parathion against *T. havilandi*, 2 per cent. parathion against *A. atromaculatus*, and BHC and chlordan against *G. scutellatus*. A test of the effect of moisture on contact action showed BHC and parathion to be considerably more toxic to all three insects on wet surfaces than on dry, but the effectiveness of the other materials was not increased. Parathion gave the best results in the stomach-poison tests, followed by DDT and BHC; the other materials were not notably toxic.

Annual Report of the West African Cacao Research Institute, April, 1949 to March, 1950.—84 pp. Tafo, 1951.

This further report of investigations on cacao carried out in the Gold Coast [*cf. R.A.E.*, A **39** 370] includes accounts of work on viruses, mealybugs and Mirids (Capsids). During work on the viruses that cause swollen shoot of cacao, it was found that inoculating cacao trees with a mild strain of virus 1A does not in all cases confer permanent immunity from a virulent one [**37** 86] and

that certain mild strains are more effective in conferring immunity than others. Further evidence was obtained that cacao from the Upper Amazon is more resistant to infection by severe strain A and more tolerant of it than West African Amelonado cacao [*cf.* **39** 371]. In work on alternative hosts of strain A, young seedlings of four plant species that had not become infected in earlier experiments [**38** 378; **39** 372] were infested with large batches of crawlers or nymphs of *Pseudococcus njalensis* Laing from infected cacao, and at the time of writing, some infection of both *Sterculia tragacantha* and *S. rhinopetala* had been obtained. *Cola chlamydantha* was found to be infected with viruses throughout an area of 200 square miles round Wiawso, and indications of widespread infection in some areas not yet under cacao were also obtained.

The work on mealybugs was almost entirely concerned with control. In tests of likely food-plants for rearing laboratory stocks to provide hosts for parasites, sprouting potato tubers gave the best results, though both tubers and sprouts were subject to bacterial and fungous infections. Chinese yams (*Dioscorea esculenta*) sprouted well in the laboratory and were less susceptible to rotting, but although mealybugs, especially *Planococcus* (*Pseudococcus*) *citri* (Risso), readily became established on the young sprouts, populations did not increase so well as on potato. Establishment on spineless cactus (*Nopalea* sp.) was unsatisfactory. *Planococcus citri* was more easily reared than *Pseudococcus njalensis* and is to be used as the main laboratory host. Rearing of the promising introduced parasite, *Anagyrus kivuensis* Comp. [**39** 373], was temporarily discontinued, since a parasite-free stock of hosts was not available, and a culture reared on field-collected *P. njalensis* became seriously contaminated by native parasites, including one closely related to *A. pullus* Comp., from which *A. kivuensis* cannot be distinguished in the living state.

A consignment of 2,000 adults and 21,000 pupae of *Leptomastix dactylopii* How. was despatched from California in December 1949 ; all the adults were dead on arrival, and though emergence from the pupae was good, about two-thirds of the resulting adults died within 48 hours. Of the rest, 925 were kept for breeding, but none survived for more than five days ; they failed to reproduce on *P. njalensis*, and the culture died out after the third generation on *Planococcus citri*. The remainder were liberated at five places in the Eastern Province, but none was recovered from large collections of mealybugs made during the following three months. Some 35,000 adults of *Scymnus binaevatus* Muls., *S. quadrivittatus* Muls., *Chilocorus angolensis* Crotch, *Exochomus flavipes* (Thnb.), and an unidentified species of the subgenus *Nephus* of *Scymnus* were received from California in September 1949 and released at four places in the Eastern Province ; with the exception of a few of each of the last two species that were collected within a week of liberation, none of these predacious Coccinellids was recovered.

When adults of *Pseudococcus njalensis* were rolled in actively sporulating plate cultures of two strains (referred to as 1 and 2) of *Aspergillus parasiticus* received from Illinois and one of *A. flavus* isolated at Tafo as a saprophyte, all three strains showed some ability to attack the mealybugs, the last being least effective. In an experiment in which spores of these three strains and one of *A. niger* were diluted in talc and applied to *P. njalensis* at the rate of 0·25 gm. dust (containing about 12,000 spores) per 100 adults in petri dishes in a dust tower, strains 1 and 2 of *A. parasiticus* gave 98 and 95 per cent. mortality, respectively, after 120 hours, and *A. niger* and *A. flavus* 5 and 11 per cent., as compared with 3 per cent. for no treatment and 4 per cent. for talc alone. Storing the dusts for ten months in corked tubes prior to use had no detrimental effect.

In tests with systemic insecticides, cacao seedlings infested by *Planococcus citri*, *Pseudococcus njalensis* or *Ferrisiana* (*Ferrisia*) *virgata* (Ckll.) were grown in nutrient solutions to which schradan (bis(bis-dimethylamino)phosphonous

anhydride) or bis(dimethylamino)fluorophosphine oxide was added at concentrations of 10, 50 and 100 parts per million. Schradan gave no control at the lower concentrations after eight weeks and permitted the survival of small colonies at the highest, but all but one of the plants treated with the oxide were free from infestation after four weeks, and all were free after five. No phytotoxic action was observed. In further tests against *Planococcus citri*, in which the insecticides were used at 200 and 500 p.p.m., adults and crawlers were still present after eight weeks on 9 of 10 plants treated with schradan at 200 p.p.m. and 6 of 10 treated at 500 p.p.m. No results were obtained with the oxide, which severely damaged the plants at the lower concentration and killed them at the higher. In other tests, two types of grease-banding material, a dust of 10 per cent. DDT applied to the ground round the trunks, 2·5 or 5 per cent. DDT painted on the lower trunks or a spray of 0·125 per cent. wettable parathion were all of some value against attendant ants in the field.

At Oyoko, the incidence of mealybugs on plots of seedling Amazon cacao varied from 2·2 per cent. in September–October to 11·4 per cent. in January–February. The seedlings were painted twice with DDT during the year against Mirids, but the treatment did not control the mealybugs, infestation by which increased from 4·6 to 6·5 per cent. after the November application. *Xyleborus morstatti* Hag. was found attacking 1·9, 3·1 and 1·1 per cent. of the seedlings in December, January and February, respectively, and the fungi, *Botryodiplodia theobromae* and *Calonectria rigidiuscula* were isolated from lesions caused by these beetles.

Work on Mirids included preliminary investigations on the anatomy and physiology of the digestive tract, which are described. A parasitic nematode was obtained from the body cavities of both *Sahlbergella singularis* Hagl. and *Distantiella theobroma* (Dist.). In studies of the reaction of these species to temperature, in which the sexes were placed separately in groups of 2–8 in a temperature gradient, peak numbers of males and females congregated at 23–25°C. [73·4–77°F.] and 17–19°C. [62·6–66·2°F.], respectively, and there was a second peak at 32–34°C. [89·6–93·2°F.] for all groups except females of *D. theobroma*, for which it was at 35–37°C. [95–98·6°F.] ; the Mirids were trapped in condensation water below 16°C. [60·8°F.] and became moribund above 43°C. [109·4°F.]. Mirids collected during the dry season tended to congregate at higher temperatures than those collected at other times, but there was no significant correlation between original cage temperatures and final distribution on the gradient.

In an experiment on the factors inducing Mirid invasion at breaks in the tree canopy [**37** 88], in which counts of chupons and Mirids were made between 28th December and 31st March on trees that had been pollarded at 4 ft. on 9th–11th November, after which half were shaded by matting at a height of 8 ft. from the ground, and on untreated trees in plots 30 ft. square, totals of 555, 197 and 39 Mirids and 683, 742 and 52 chupons were taken from the unshaded, shaded and control plots, respectively. Mirids entered the plots on about the same dates, and the differences in population are therefore attributed not to variations in chupon production but to differences in the reproductive rate, possibly resulting from differential behaviour of the fertilised females with regard to light. The trees in two of three Mirid pockets that were coppiced late in 1946 [**39** 373] bore pods in 1949, whereas there was no improvement in the condition of trees that were not coppiced but sprayed fortnightly with 0·1 per cent. nicotine sulphate. To provide a guide to the size of sampling units, the frequency distribution of *S. singularis* and *D. theobroma* on 1,088 cacao seedlings in a fairly homogeneous area was first estimated on the assumption that it would be fitted by a negative binomial distribution ; this was found to agree with the observed distribution, and the numbers of seedlings necessary for estimates within 5 and 10 per cent. of the true mean were calculated to be 900

and 700, respectively. With careful classification, a much smaller sample would probably be representative, since it was possible to select parts within the area that were more liable to attack than others. The total numbers of pods harvested per 100 trees during 1947–49, following the formation of a Mirid pocket, from cacao showing slight, severe or no damage were 4,277, 1,101 and 8,838, respectively. Of a number of seedlings planted late in 1948 on which no measures against Mirids were carried out, 33·2 per cent. were healthy in March 1949, 46·8 and 10·5 per cent. showed slight and severe damage, respectively, and 9·5 per cent. were dead. Damage by *D. theobroma* observed in a cacao plot in a forest reserve in 1948 [**39** 374] had healed by November 1949, when neither Mirids nor fresh damage was noted ; small colonies of *Pseudococcus njalensis* were fairly common, and large numbers of Psyllids were present on flush shoots, but did not appear to be injurious.

In investigations on control, deposits left by an emulsified solution of 1 per cent. DDT on pieces of pod cortex and chupon and on leaves from a hardened flush gave only 25 per cent. mortality of adults of *Bryocoropsis laticollis* Schum. and *S. singularis* in intermittent contact with them for 24 hours, though most of the Mirids showed symptoms of poisoning, but mortality was 85–100 per cent. after constant contact for the same period. When twigs were painted with 1 per cent. toxaphene or DDT, the respective mortalities, corrected for mortality in the controls, among fourth- and fifth-instar nymphs, mostly of *S. singularis*, that were confined on them for 18 hours were 68·4 and 42·8 per cent. ; the corresponding mortalities on seedlings in an insectary were 76·3 and 43 per cent. In a field test on young cacao that was treated with 2·5 per cent. DDT as an emulsified solution or an oil-bound suspension or 0·3 per cent. γ BHC (benzene hexachloride) as a fine suspension or an emulsified solution, the percentages of trees showing Mirid damage after four months were 5·1, 11·2, 4·2 and 0·5, respectively, as compared with 20·7 for no treatment. The γ BHC caused slight scorching. In May 1949, 25 trees that had been injured by a falling tree three months earlier were sprayed with 0·5 per cent. wettable DDT, and further applications of 1 per cent. wettable DDT were made in September 1949 and January 1950. At the time of writing, the trees showed little damage by Mirids and appeared to be healthy, whereas 80 untreated ones had become heavily infested and were dead or dying as a result of feeding by the Mirids and attack by *Calonectria rigidiuscula*. A fine jet that directs a small volume of insecticide on to branch unions and forks, where it is most effective against Mirids, has been developed at Tafo for the economic application of insecticides to cacao. Experiments with smoke generators indicated that their use in mature cacao during the dry season is not feasible at dawn or mid-day, but that suitable conditions exist at dusk, though it requires skilled operators to recognise them.

RAINEY (R. C.) & SMIT (B.). **Cotton and its Pests in South Africa. Ratooning as a Threat to the Revival of Cotton-growing in the Union.**— *Sci. Bull. Dep. Agric. S. Afr.* no. 308, 17 pp., 2 figs., 47 refs. Pretoria, 1950.

Ratoon cotton was formerly widely grown in South Africa, but was found to encourage the development of insect pests, since it resulted in the presence of an almost continuous food-supply. The practice has recently been recommended, however, as it was considered that the evidence that it favoured cotton pests was inadequate ; the evidence quoted dated from 1927–28. In view of this, and also of the present revival of cotton-growing in South Africa and the local establishment in one of the main cotton areas of a season during which ratooning is prohibited [*cf. R.A.E.*, A **26** 365], the authors review from the literature the results of more recent research on the seasonal history, food-plants, incidence and control of each of the major pests of cotton in South Africa.

It is concluded that the evidence against ratooning is overwhelming and that *Diparopsis castanea* Hmps. and *Dysdercus fasciatus* Sign., two of the most important cotton pests, are very largely dependent on it for their continued existence over much of the cotton-growing area. It is pointed out that ratoon plants of the varieties grown in Peru, Brazil and the West Indies, where this method of cultivation is successful, differ from those in South Africa in producing flower buds at the same time as annual cotton, so that the season is not extended. Furthermore, ratoon crops were recommended in South Africa primarily to reduce the hazard of crop loss due to late rains, and this has been largely overcome by the development of early strains of cotton, which give greatly increased yields.

SHULOV (A.). **The Development of Eggs of *Schistocerca gregaria* (Forskål) in Relation to Water.**—*Bull. ent. Res.* **43** pt. 3 pp. 469–476, 11 refs. London, 1952.

The development of the embryos in eggs of *Schistocerca gregaria* (Forsk.) under controlled conditions of temperature and humidity was investigated, with particular attention to the influence of water. The normal course of development in wet sand at 27°C. [80·6° F.] is described. The percentages of the eggs that hatched in wet sand were 70–90 at this temperature or 30°C. [86°F.], 25 at 20°C. [68°F.] and 10 at 33°C. [91·4°F.]. In experiments at a relative humidity of 100 per cent., the embryos in eggs not in contact with water ceased to develop at late anatrepsis and died within 20 days. Development was resumed, however, and completed in 11 days if the eggs were wetted six, ten or 15 days after they were laid, the embryos being then in the stage of late anatrepsis, which is the stage in which those of some other Acridids undergo diapause. If the eggs were in contact with water for only three days after they were laid, a few absorbed enough for development and hatching to be completed, though most of the embryos died during katatrepsis and some when about to hatch.

PRITCHARD (A. E.). **A new Gall Midge Predator of Mealybugs, *Coccomyza donaldi* (Diptera: Cecidomyiidae).**—*Bull. ent. Res.* **43** pt. 3 pp. 477–478, 1 fig., 1 ref. London, 1952.

The Cecidomyiid, *Coccomyza donaldi*, sp. n., is described from adults of both sexes found preying on *Pseudococcus bukobensis* Laing in the Gold Coast in the course of investigations on the natural enemies of mealybugs that transmit the virus of the swollen-shoot disease of cacao there.

SNOW (O. W.) & TAYLOR (J.). **The large-scale Control of the Cotton Jassid in the Gezira and White Nile Areas of the Sudan.**—*Bull. ent. Res.* **43** pt. 3 pp. 479–502, 1 pl., 1 fig., 7 refs. London, 1952.

Empoasca lybica (de Berg.) was formerly thought to be of little importance as a pest of cotton in the Gezira area of the Anglo-Egyptian Sudan. Its injuriousness was demonstrated by the increases in yield obtained in small-scale tests in which it was controlled by sprays [*R.A.E.*, A **35** 293], and evidence is discussed suggesting that it has been harmful at least since 1931. Spraying against it on a large scale was begun in 1945–46 [*cf.* **37** 327] and was continued over increasing areas in subsequent years with tractor-drawn sprayers and helicopters fitted with spraying equipment. The treatments and yield records obtained from 1946–47 to 1950–51 are discussed. Treatment was also extended to the White Nile area, and the results obtained there are similarly recorded. The following is based on the authors' summary.

In the Gezira, most of the spraying was carried out on Domains Sakel cotton, and the treatment mostly used was an emulsified solution of 0·1 per cent. DDT applied at about 100 gals. (1 lb. DDT) per acre by tractor-drawn sprayers in October or November. During 1946–49, yield increases became progressively smaller with lateness of spray application, but in 1949–50 there was no significant difference between increases for various dates of spraying. On the average, therefore, early spraying was advantageous. Since the Jassid population gradually increases during October and November, it is inferred that the ultimate effect of one Jassid on yield may be greater in October than in November. Yield increases were good in 1946–47, 1947–48 and 1949–50, but were smaller in 1948–49, though still substantial when sprays were applied early, and were also small in 1950–51, though a full analysis was not available. Some land was treated with nitrogenous fertilisers prior to sowing, and there were consistent indications that yield increases attributable to spraying were rather greater for manured than for unmanured land, though the difference was significant in only one case. Considerable areas were sprayed with 0·1 per cent. wettable DDT in November with consistently though not significantly inferior results. Further small areas were sprayed with emulsified solutions containing 0·075 or 0·05 per cent. DDT, and slightly, but not significantly, lower yields were obtained from them than from areas treated at 0·1 per cent. Spraying had no adverse effect on the grade of the cotton ; the increases in yield were obtained mainly or entirely in the latest pickings. Yield increases obtained by applying an emulsified solution of DDT by helicopter at a rate of 1 lb. DDT in 3 gals. spray per acre appeared satisfactory in limited tests.

The population of *E. lybica* normally decreases from north to south [*cf.* **35** 293]. The earlier spraying operations were carried out in the north, but all parts of the Gezira were included in 1949–50. In that season, infestation was relatively heavy, and yield increases due to spraying also decreased from north to south. In 1950–1951, when infestation was lighter and a similar trend was observed, there may have been no benefit from spraying in the extreme south. The variety X1730A is grown in the south of the Gezira, and in 1949–50 the increase in yield following spraying was greater for this variety than for Domains Sakel under comparable conditions. Yield increases of about 100 lb. lint and 200 lb. seed were quite common during the period under review. Since an increase of only 1 lb. high quality lint per acre over a large area has high monetary value, variations in spraying efficiency are important.

In the White Nile area, yields in some places had fallen to a low level by 1946–47, owing to overcropping during the war. When spraying against the Jassid combined with manuring before sowing was tested in 1947–48, excellent results were obtained, and spraying with DDT became general from 1948–49. Yields had reached a high level at the time of writing.

SIMMONDS (F. J.). **Parasites of the Frit-fly, *Oscinella frit* (L.), in eastern North America.**—*Bull. ent. Res.* **43** pt. 3 pp. 503–542, 41 figs., 1 graph, 47 refs. London, 1952.

Oscinella frit (L.) is of little economic importance in North America, and since it was thought that parasites might be a limiting factor there, studies were made in Ontario in 1942–44 and supplemented by surveys in the eastern United States, with a view to introducing suitable species into England. An account of the work is given, together with a review of the literature on *O. frit* in North America and notes on its systematics and synonymy and its bionomics in the laboratory. Its life-history in Ontario is similar to that in England [*cf. R.A.E.*, A **7** 68 ; **9** 533 ; **19** 640], except that wheat, not oats, is attacked and there appears to be no regular ear-infesting generation [*cf.* **8** 183]. A number of other Chloropids were associated with it on wheat in Ontario, of

which the chief were *O. carbonaria* (Lw.), *O. soror* (Macq.) and *O. minor* (Adams). Breeding experiments tended to confirm the view that *O. frit, O. carbonaria* and *O. soror* are distinct [*cf.* **28** 61], and characters are given differentiating the fully grown larvae of *O. frit, O. carbonaria, O. minor,* and *Elachiptera costata* (Loew) and *Meromyza americana* Fitch, which also attacked wheat.

The parasites reared from *O. frit* in Ontario comprised an undescribed species of *Hexacola* and another of *Polyscelis*, both of which attacked the larvae, and *Callitula bicolor* Spin., *Spalangia drosophilae* Ashm., a species of *Loxotropa* that is almost certainly identical with the British *L. tritoma* (Thoms.) [**18** 518], and *Rhoptromeris* sp., all of which parasitised the pupae. In addition, a species of *Cyrtogaster* that was obtained by sweeping readily attacked the pupae in the laboratory. Accounts, based on laboratory studies, are given of the bionomics of all the parasites except *Rhoptromeris*, with descriptions of the immature stages. *S. drosophilae, Loxotropa, Hexacola* and *C. bicolor* were also reared from *O. minor* and *O. carbonaria* or *O. soror*, *S. drosophilae* from *M. americana*, and *Polyscelis* from *O. carbonaria*; *Polyscelis* was the only one that showed a definite preference for *O. frit*. Predators appeared to be rare.

From a study of the importance of the parasites, it is concluded that control is effected by the complex as a whole. A comparison of the parasite complexes in Ontario and England indicated that *Spalangia* is the most promising species for introduction into England, since the others either already occur or have counterparts there. By reason of its ability to increase considerably when other parasites are scarce, it might serve as a controlling factor.

BENSON (R. B.). **A new *Anoplonyx* destructive to Larch in Britain (Hymenoptera : Tenthredinidae).**—*Bull. ent. Res.* **43** pt. 3 pp. 543–547, 7 figs., 7 refs. London, 1952.

A sawfly considered to be *Anoplonyx* (*Leptocercus*) *duplex* (Lep.) has long been present on larch in Britain and has increased in importance with the more extensive planting of that tree. In 1947, a serious outbreak occurred in Perthshire, and *Larix kaempferi* (*leptolepis*) and *L. decidua* were defoliated over many acres. The sawfly reproduces entirely by parthenogenesis, and no males have been observed. It differs in this and also in characters of the larva and adult from central European *A. duplex*, and its identity was therefore investigated. Comparison with material from various countries showed that it differed from the known Palaearctic and Nearctic species of the genus, and it is therefore described from females taken in Britain as *A. destructor*, sp. n. Two examples of it were seen from Finland, where it was stated to be very rare. A key to the European species of *Anoplonyx* and comparative notes on the morphology of the European and North American species are appended.

Distribution Maps of Insect Pests.—Series A, nos. 19–24. London, Commonw. Inst. Ent., 1952.

These maps are nos. 19–24 of a series already noticed [*R.A.E.*, A **40** 203] and deal, respectively, with *Pieris rapae* (L.), *Thrips tabaci* Lind., *Distantiella theobroma* (Dist.), *Sahlbergella singularis* Hagl., *Macrosiphum pisum* (Harris) and *Saissetia oleae* (Bern.).

FINLAYSON (L. H.). **Mortality of *Laemophloeus* (Coleoptera, Cucujidae) infected with *Mattesia dispora* Naville (Protozoa, Schizogregarinaria).**—*Parasitology* **40** no. 3–4 pp. 261–264, 4 graphs, 6 refs. London, 1950.

Microscopic examination of dead larvae and adults of *Laemophloeus minutus* (Ol.) and *L. ferrugineus* (Steph.) from cultures kept at 25°C. [77°F.] and 70 per

cent. relative humidity in which mortality was abnormally high showed them to be heavily infected by a schizogregarine subsequently identified as *Mattesia dispora*, which is also known from *Ephestia kuehniella* Zell. and *Plodia interpunctella* (Hb.) [*cf. R.A.E.*, A **26** 598]. Sporocysts were present in the fat-body, sometimes obliterating it and filling the entire body cavity, and they, and probably sporozoites, also occurred in the blood.

In a quantitative experiment on the effect of the parasite, cultures comprising 20 females, 20 males or 20 larvae obtained from a stock culture of *L. minutus* were maintained, under controlled conditions, on whole wheat flour sterilised at about 58°C. [136·4°F.] for 24 hours to destroy mites, or a mixture of wheat flour and 10 per cent. brewer's yeast from an infected culture that was sieved to remove dead adults, either dried at 50 per cent. relative humidity and room temperature for four days or sterilised to destroy mites, and mixed with an equal quantity of uninfected sterilised flour. The cultures were examined every few days. In the experiments with females, the control populations increased normally, but there was a gradual decrease in the cultures on sterilised infected food, and a more rapid one in those on dried infected food, in which the first generation did not develop beyond the larval stage. In the experiments with larvae, mortality was also high on the infected food, especially the dried food, and none of the progeny of the adults produced completed development. Mortality among the males was low in all cultures, but was slightly higher on the sterilised than on the dried food. The higher mortality rates of the females and larvae are attributed to the larger numbers resulting from breeding, and the presence of dead larvae, which are eaten by other larvae and adults, both factors favouring the rapid spread of infection. Schizogony and the hatching of the spores take place in a single host, and the life-cycle of the parasite is so short that the presence of a few spores probably leads to a lethal infection within a few weeks ; the males therefore appear to be more resistant than the females. However, infected cultures containing both sexes are often completely destroyed, and dead males have frequently been found full of spores. It is possible that the spores are carried by mites, but no intermediate host or vector is necessary for transmission. In another experiment, in which adults of *L. minutus* were kept on infected food, deaths occurred within 20 days and 25 per cent. were dead in 40 days, whereas in a similar culture on uninfected food, mortality did not occur for about 50 days and may then have been due to accidental contamination.

L. minutus, *L. ferrugineus*, and *Laemophloeus* sp. of Lucas & Oxley [*P. pusilloides* Steel & Howe (*R.A.E.*, A **40** 362)] readily became infected when placed on food containing spores obtained by grinding up dead infected adults and larvae, but *L. turcicus* Grouv. did not become infected and no cases of infection were found in cultures of it. Larvae of *E. kuehniella* and *P. interpunctella* that fed on infected flour were killed by *M. dispora*. Another schizogregarine that occurs in the fat-body of *E. kuehniella* and is highly pathogenic was described by S. Ghélélovitch in 1948 as *Coelogregarina ephestiae*. A cephaline gregarine, *Gregarina laemophloei*, occurred in varying numbers in most of the *Laemophloeus* examined, and large ones of uncertain identity were numerous in some larvae of *Ephestia*. The effect of these on their hosts is unknown, but in view of their large size and frequent abundance, it must sometimes be considerable.

PAINTER (R. H.). **Insect Resistance in Crop Plants.**—$8\frac{1}{2} \times 5\frac{3}{4}$ ins., xi+520 pp., 67 figs., many refs. New York, N.Y., Macmillan Co., 1951. Price £3 11*s.* 6*d.*

This book is based on a comprehensive study of the literature published, for the most part, up to the end of 1949 and on the author's experience as leader of a co-operative study of insect resistance in crop plants in the United

States over some 25 years. In addition to collating and summarising information that was hitherto scattered throughout the literature on several branches of science, it contains tentative conclusions regarding resistance to insects that are put forward as a basis for further study. Resistance is defined as the relative amount of heritable qualities possessed by the plant that influence the ultimate degree of damage done by the insect. These qualities and their effect on insects are discussed in an introductory chapter, and another deals with the factors that influence the extent to which they are developed and persist or that modify the responses of the insect to the plant. These are followed by detailed discussions of resistance in wheat, maize, cotton, sorghum and potato, in which the author gives information on the crop plant concerned, lists of those of its insect pests to which resistance has been observed, and accounts of work done on them in different parts of the world, including studies on the bionomics of the insects and the damage caused by them, the breeding of plants for resistance, the characteristics of resistant plants and the value of resistance as a control measure. In the final chapter, the special methods employed and problems that arise in breeding resistant plants are discussed, together with the organisation of work of this type. Each chapter has its own bibliography, but extensive supplementary lists of papers dealing with resistance are appended ; these include some more recent papers on the five crops dealt with in detail, some on resistance in other plants, including fruit, ornamentals and forest trees, and a few on resistance to termites in timber.

BAILEY (S. F.) & SMITH (L. M.). **Handbook of agricultural Pest Control.**—$7\frac{1}{2} \times 5$ ins., 191 pp., 1 fig. New York, N.Y., Industry Publ., Inc., 1951. Price $3.25 or (foreign and Canada) $3.75.

This handbook provides a concise summary of technological data of use to growers and others concerned with the application to plants of insecticides and fungicides and of other compounds used in sprays or dusts and is of general interest though restricted in some respects to conditions in the United States. Much of the information is in the form of tables, and the book comprises three main parts, dealing with chemical compounds, equipment, and miscellaneous subjects, respectively. The first contains lists of the materials used and information on the chemical and physical properties, compatibility and toxicity to man of the commoner ones, the use of fumigants, specifications for spray oils and the official U.S. tolerances for toxic residues. The second is concerned with the performance of power sprayers and dusters, the calculation of rates of delivery from spraying and dusting equipment and aerosol dispensers, the construction of thermal aerosol generators and methods of ensuring the correct rates of application from equipment of different types, including blower sprayers and high power dusters. It also includes a section on the use of aircraft for the application of sprays and dusts, with a short discussion of different types of aircraft and data for the determination of rates of application. The third part deals with the hazards to plants, human health and beneficial insects involved in chemical control, and includes lists of repellents and wood preservatives, arithmetical formulae for the determination of concentrations, rates of application and capacities, tables of conversions and equivalents, and a glossary of terms used in technical work.

ORDISH (G.). **Untaken Harvest. Man's Loss of Crops from Pest, Weed and Disease. An introductory Study.**—$8\frac{3}{4} \times 5\frac{1}{2}$ ins., xii + 171 pp., 5 graphs, 118 refs. London, Constable & Co., Ltd., 1952. Price 15*s*.

In surveying the economic aspects of the losses of agricultural crops caused by plant and animal pests and virus diseases, largely with reference to conditions in Britain, the author discusses the extent of such losses in different countries

of the world in terms of their financial value and also in terms of wasted effort and land, and considers the economic and social consequences arising from the actual losses or in connection with the measures taken to prevent them. He also deals with the economic relation of different methods of pest control to production, the factors limiting progress in crop protection, and the main requirements for obtaining improved control, and in a concluding chapter gives a brief history of the development of the trade in insecticides and other materials used in pest control, including a table showing the consumption, production, and amounts exported and imported for different countries.

RIEMSCHNEIDER (R.) & SCHÖLZEL (E.). **Literatur zur HCH- und Diën-Gruppe. Liste III. Abgeschlossen im wesentlichen 1. Juli 1950.** [Literature on the Benzene-hexachloride and Diene Group. List III. Closed mainly 1st July 1950.]—128 pp. Berlin, P. Parey, 1952.

This list is the third of a series of which the first two were circulated in manuscript. It is being published concurrently in the *Zeitschrift für angewandte Entomologie* in three parts (**33** pts. 3–4, **34** pt. 1) and comprises a bibliography of well over 2,000 works published up to 1st July 1950 on insecticides of the benzene-hexachloride and diene groups. The term diene group includes not only compounds produced by diene synthesis, such as chlordan, aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene] and dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene], but also, for convenience, those, such as toxaphene, obtained by direct halogenation of terpenes. The entries for each paper comprise the full title and bibliographical reference, references to abstracts if available, and indications of the group or groups of insecticides concerned, with the DDT and E (phosphorus) groups included when they are also dealt with, and the main aspects treated (chemical, physical or biological).

RIEMSCHNEIDER (R.). **Ein Beitrag zur Toxikologie kontakt-insektizider Substanzen.** [A Contribution to the Toxicology of contact-insecticidal Substances.]—*Anz. Schädlingsk.* **22** pt. 1 pp. 1–3, 18 refs. Berlin, 1949.

Contact insecticides consisting of halogenated hydrocarbons or phosphoric-acid esters do not show the same order of relative toxicity to mammals as to insects, and an account is given of laboratory investigations of the acute and chronic toxicity of some of them to rats. For acute toxicity, they were administered orally in olive oil. The median lethal dosages in mg. per kg. body-weight were 10–12·5 for E 605 (parathion), 175 for M 414 (octachloro-endomethylene-trimethylcyclohexane), 200 for M 410 (chlordan), 200 for p,p′fluoro-DDT (DFDT), 225 for p,p′DDT, 225 for γ BHC (γ benzene hexachloride), 750 for δ BHC, 1,000 for o,p′fluoro-DDT, 1,250 for o,p′DDT, 1,500 for α BHC and 1,750 for p,p′DDD (α, α-bis (4-chlorophenyl)-β, β-dichloroethane). E 605 was the most rapid in effect, the first reaction to the poison appearing within an hour and death occurring in 15–25 hours. Mortality for β BHC at 2,000 mg. per kg. was less than 10 per cent., and 100 mg. ε BHC administered to a single rat weighing 150 gm. caused no symptoms of poisoning.

In the tests of chronic toxicity, M 410, p,p′DDT and E 605 were administered daily to rats at rates of 1, 5 and 10 mg. per kg. body-weight. [illegible] DDT had no effect after 75 days, but rats given E 605 at the two [illegible]d after 4–8 and 2–5 days, respectively. When small amo[illegible] were included in the diet of the rats and their organs examined after a [illegible] evidence of the accumulation of the poisons was found in those given 0·4 gm. per kg. food, but not in those given 0·25 gm.

HOCHAPFEL (H.). **Beobachtungen über das Auftreten der Saatenfliege (*Hylemyia platura* Meig.) an Bohnen und Gurken.** [Observations on the Occurrence of *H. cilicrura* on Beans and Cucumbers.]—*Anz. Schädlingsk.* **22** pt. 3 pp. 37–38, 3 figs., 3 refs. Berlin, 1949.

Dwarf beans sown near Mannheim on 25th–26th June 1948 were reported in July to have the seed leaves or growing shoot so damaged by insects that further growth was inhibited. Injury of a similar type had occurred in the same place in 1946 and had been observed by the author in 1938 and 1941 on cucumber in Lower Silesia. It was caused there by the seed-corn maggot, *Hylemyia cilicrura* (Rond.) (*platura*, auct.), the only previous record of which in Germany was on lupin and rye in Silesia in 1916. It is a common pest in Japan, and its bionomics and the control measures recommended there are reviewed from the literature [*R.A.E.*, A **22** 485, etc.]. A search for the larvae in the bean field on 20th July 1948 revealed only one, fully-grown example, and it was concluded that the July generation had already pupated. If 18 days are allowed for the egg and larval stages, adult emergence and oviposition must have occurred mainly between 25th and 30th June. The weather during that period had been favourable, since rain fell almost daily. About a third of the field was protected from wind by adjacent buildings, and infestation was heaviest in that area, where about 50 per cent. of the plants were affected. Damage was slight in a neighbouring field that had been sown a week earlier, and did not occur in another, sown on 9th July. This suggested that infestation was dependent on climatic conditions and sowing date, and that it might be avoided by sowing on a suitable date, after oviposition had ended and before pupation began. Chemical control would not be justified unless severe damage occurred regularly.

LIEBSTER (G.). **Neue Ergebnisse in der Bekämpfung der Apfelsägewespe (*Hoplocampa testudinea* Klg.).** [New Results in the Control of the Apple Sawfly (*H. testudinea*).]—*Anz. Schädlingsk.* **22** pt. 3 p. 39. Berlin, 1949.

Apple trees in north-western Germany have to be sprayed regularly against *Hoplocampa testudinea* (Klug) if a satisfactory crop is to be obtained. In the past, nicotine or quassia applied just after petal-fall gave some control, but they became difficult to obtain and tests with alternative materials were begun in 1947. Lead arsenate, E 605 f [an emulsion concentrate containing 70 per cent. parathion] and a preparation containing BHC (benzene hexachloride) gave promising results in that year, whereas Gesarol (DDT) and Bladan [hexaethyl tetraphosphate (*cf. R.A.E.*, A **37** 487)] proved ineffective. Further tests were carried out in 1948, when the percentages of fruits infested were 13·3 for no treatment, 2·4 for 0·4 per cent. lead arsenate, 3 and 1 for 0·2 and 0·4 per cent. Nexen (a BHC preparation), and 7·6 and 1·25 for 0·01 and 0·025 per cent. E 605 f, respectively. Higher concentrations of E 605 f did not give sufficiently increased control to warrant their use. Sprays of 0·025–0·03 per cent. E 605 f or 0·4 per cent. Nexen are recommended.

RUPP (P.). **Reblausbekämpfung und Rebaufbaumassnahmen.** [Control of the Vine Aphid and Measures for Vine Replacement.]—*Anz. Schädlingsk.* **22** pt. 3 pp. 41–43. Berlin, 1949.

Infestation of grape vines by the vine Aphid [*Phylloxera vitifoliae* (Fitch)] increased considerably during and after the war in all the vine-growing areas of Germany. Investigations in Rheinhessen in 1946 showed that about 250 acres, comprising outbreak centres and safety zones, would have to be cleared under the regulations for control of the Aphid, and the situation deteriorated still further in 1947. The reasons for the increase were warm summers in 1943 and 1945–47 and failure of the growers to comply with the legal restrictions. With the widespread replanting required, the situation with regard

to the procurement of new resistant stocks became acute. The raising of these in Germany is under strict regulation, since the American vines or hybrids of American and European vines used for them, although resistant to the root form of the Aphid, are susceptible to the leaf form, which is still more dangerous. The import of several million root stocks from Italy was expected to provide considerable relief.

JANCKE (O.). **Der Birnprachtkäfer (*Agrilus sinuatus* Oliv., Buprestidae).** [The Pear Buprestid (*A. sinuatus*).]—*Anz. Schädlingsk.* **22** pt. 4 pp. 51–57, 9 figs., 13 refs. Berlin, 1949.

In 1946–47, the author examined numerous unthrifty pear trees in the Palatinate and Rheinhessen and found them to be heavily infested by *Agrilus sinuatus* (Ol.), the larvae of which bore in the sapwood. The damage caused to the trees is described. It resulted in premature shedding of fruit and loss of foliage, twigs and branches and, if continued for several years, in the death of young trees. The distribution, food-plants, bionomics and control of this Buprestid are reviewed from the literature [*cf. R.A.E.*, A **23** 101], and Reitter's description of the adult is quoted. Pupal chambers were found in trunks and branches of a finger's breadth or more and were usually situated at depths of 0·02–0·3 in. in the heartwood. Surface applications of 0·02–0·05 per cent. E 605 f [an emulsion concentrate containing 70 per cent. parathion] to infested branches in May 1948 had no effect on larvae in the sapwood.

LÜDICKE (M.). **Weitere Untersuchungen über das Eindringungsvermögen des Insektizids E 605 f in lebende pflanzliche Gewebe.** [Further Investigations on the penetrating Power of the Insecticide E 605 f in living Plant Tissue.]—*Anz. Schädlingsk.* **22** pt. 4 pp. 58–62, 4 figs., 4 refs. Berlin, 1949.

An account is given of experiments in Germany in which partly developed larvae of various leaf-mining Diptera in the leaves of their food-plants were killed by the application to the latter of 0·05 per cent. E 605 f [an emulsion concentrate containing 70 per cent. parathion]. The insecticide was applied to a spot on the leaf directly above or below the larva or round it in such a way as to isolate it from the rest of the leaf. Spraying the leaves also killed the larvae mining in them. In two tests in which berries of *Lonicera tatarica* infested with eggs of *Rhagoletis cerasi* (L.) were sprayed in June 1948 with 0·05 per cent. E 605 f, picked a week later and kept on soil in petri dishes, together with unsprayed berries from the same bushes, puparia were obtained from 6·6 and 14·4 per cent. of the eggs in the sprayed berries and from 41·5 and 36·5 per cent. of those in the untreated ones. Comparable results were obtained in later tests in which E 605 f was used at 0·03 as well as 0·05 per cent. There was no evidence of spray residues on the berries affecting the fully-fed larvae as they emerged to pupate.

BÖHM (O.). **Über die Wirkung von p,p′-Dichlordiphenyltrichloraethan (DDT) auf Insekten unter besonderer Berücksichtigung der Abhängigkeit der Kontaktgiftwirkung vom Bau des Insektenintegumentes. Beitrag zur Kenntnis der Wirkungsweise eines modernen synthetischen Kontaktinsektizides.** [On the Effect of p,p′ DDT on Insects with special Reference to the Dependence of its Effectiveness as a Contact Poison on the Structure of the Insect Integument. Contribution to the Knowledge of the Mode of Action of a modern synthetic Contact Insecticide.]—*Pflanzenschutzberichte* **7** pt. 3–4 pp. 33–73, 10 figs., many refs. Vienna, 1951. (With a Summary in English.)

The literature on the mode of action of DDT on insects is briefly reviewed [*cf. R.A.E.*, A **35** 203], and an account is given of investigations on factors

governing its penetration through the integument. The DDT used was the technical product containing about 70 per cent. p,p′isomer, and in the main tests, this was dissolved at 1 per cent. in ether for topical applications, which were made to the abdominal terga at the rate of 100 mg. DDT per kg. body weight, and at 1–0·01 per cent. in cod-liver oil for injections, which were made intersegmentally on the dorsal side of the abdomen at 100–1 mg. per kg.

In a preliminary test demonstrating the passage of DDT unchanged through the cuticle, fully-grown larvae of *Tenebrio molitor* L. and fourth-instar larvae of *Leptinotarsa decemlineata* (Say) were killed by contact with a DDT film and the haemolymph and body tissues mixed with talc, dried and crushed. Acetone extracts of these were toxic to house-flies (*Musca domestica* L.) and produced typical symptoms of DDT poisoning in them. The haemolymph of *L. decemlineata* was less toxic than that of *T. molitor*, which is more resistant to DDT. In tests on the site of action of DDT, degeneration of the nerve cells was observed in thoracic ganglia of treated larvae of *T. molitor*, but heart activity was not affected in fourth-instar larvae of *L. decemlineata*. The view that hydrogen chloride is liberated at the site of action [*cf.* **34** 255] would suggest an alteration in the pH value of the lymph of poisoned larvae but none was found, injections of dilute hydrochloric acid into fully-grown larvae of *T. molitor* did not produce typical symptoms of DDT poisoning, and symptoms caused by DDT were not affected by external treatment with sodium carbonate.

In the main experiments, various stages of insects of 13 species were treated topically and by injection. Some species reacted quickly to topical applications, some were immune to them but reacted quickly to injections, and others showed some reaction soon after topical applications but recovered rapidly and were unaffected by injections at 10 mg. per kg. It is concluded that resistance to DDT varies with the permeability of the integument and with the physiological characteristics of the insect. Assessments of the permeability of the cuticle for the 13 species are given in a table. In general, larvae in early instars possessed a more permeable cuticle than those in later ones or adults. In adults, thin parts of the integument and chemo-receptive and other sense organs constitute especially sensitive sites of entry for DDT [*cf.* **37** 115], and the importance of these sites and organs in larvae was investigated. The abdominal stigmata of the larvae of *M. domestica* and the orifices of the dorsal glands of larvae of *Melasoma saliceti* Weise did not constitute special sites of entry for DDT, and the fly larvae showed the same reactions to local applications on various parts of the cuticle. There was, however, a direct relation between the permeability of the cuticle and the numbers of pores per unit area in larvae of *T. molitor* of various ages and of skin glands in nymphs and adults of *Blatta* (*Periplaneta*) *orientalis* L. No direct relation was established between permeability and the numbers of hair pores or sensory organs per unit area, the total thickness of the cuticle or the structure of the pore-canals. Investigations on the epicuticle of the 13 species of insects showed that the nature of the lipoids present strongly affected the permeability of the integument, which was reduced by cement layers and heavy polymerisation of fatty materials. A graph is given showing the varying intervals between topical treatment with DDT and the appearance of symptoms of poisoning in larvae of *Melasoma* just prior to and following the second moult. The newly-moulted larvae were particularly susceptible to DDT, as also were those of other insects in similar tests, and this is attributed to lack of sclerotin and the absence of the endocuticle.

In investigations of the physical and chemical properties of the cuticle, experiments by the technique of Skvortzov [**37** 43] showed that ether, acetone and chloroform as vapour penetrated cuticle from larvae of *M. domestica*, but these solvents, absolute alcohol and fatty oils did not penetrate as liquids. Water permeated slowly. Thus the integument formed a hydrophilic rather than a

lipophilic system. The results of permeability tests with DDT solutions varied with the nature of the solvent used. About 50 mmg. DDT in acetone solution and about 125 mmg. in acetone with 25 per cent. water penetrated cuticle from the fly larvae in 36 hours. Further tests with cuticles from larvae of *M. domestica* and other Diptera and puparia of *M. domestica* showed that DDT in lipoid solvents penetrated all of them. The quantity that did so depended on the nature of the solvent and probably varied directly with the time allowed for penetration and the concentration of the solution. The cuticle of DDT-resistant species (*Lucilia caesar* (L.) and *Sarcophaga carnaria* (L.)) was less permeable than that of the relatively sensitive *M. domestica*, and in the latter, cuticle from puparia was less permeable than that from larvae. Penetration occurred more easily from epicuticle to endocuticle than in the reverse direction. Lipoid extraction with chloroform rendered larval cuticle of *Musca* almost impermeable to DDT. When the chitin was broken down by treatment with potassium hydroxide, penetration was variable, the values being intermediate between those for fresh cuticle and for cuticle subjected to lipoid extraction.

In adsorption tests, fully-grown larvae of *T. molitor* suffering from severe DDT poisoning were washed in acetone to remove superficial DDT, and all orifices, including the stigmata, were sealed. The larvae were then enclosed in petri dishes with adults of *M. domestica*, which showed symptoms of DDT poisoning after 4–7 hours. Similar results were obtained when the larvae were encased in plaster of paris with only part of the terga exposed. In a second series of tests, the flies were confined with larvae of *T. molitor* or *L. decemlineata* in plaster immediately or 0·5, 1, 2 or 6 hours after washing with acetone, and the periods elapsing before signs of poisoning were apparent averaged 140, 81, 73, 87 and 135 minutes, respectively, for *T. molitor* and 175, 65, 70, 97 and 300 minutes for *L. decemlineata*. It is concluded that DDT is stored in the cuticle, is absent from the surface immediately after washing but is again present after 30 minutes and is then absorbed by the insect body, more quickly in *L. decemlineata* than in *T. molitor*. House-flies enclosed with larvae of the latter 12 hours after washing with acetone showed a DDT reaction after 6·5 hours, but those enclosed with the former, or with either species after 24 hours, showed none. The quantities of DDT in acetone adsorbed in an hour by the cuticle of larvae of various Diptera or puparia of *M. domestica* were measured, and it is concluded that insect cuticle has a high adsorptive capacity for DDT and that adsorption is in the main linked with the intact chitin-protein complex. Since ether, acetone and chloroform are used as solvents for DDT, the quantities of lipoids that they extract from the cuticle were determined. The amounts were slight in larvae of *M. domestica* and *S. carnaria*. More permeable integuments contain a larger quantity of extractable lipoids. A further experiment in which larvae of *M. domestica* were treated dorsally with DDT before, during and after the formation of the puparium showed that only slight traces of sclerotin rendered the integument impermeable to DDT.

Böhm (H.). **Ein neuer Schädling in Österreich, *Hyphantria cunea* Drury (Lep., Arctiidae).** [A new Pest in Austria, *H. cunea*.]—*Pflanzenschutzberichte* **7** pt. 11–12 pp. 177–189. 9 figs., 9 refs. Vienna, 1951. (With a Summary in English.)

Hyphantria cunea (Dru.), which has been known in Hungary since 1940 (*cf. R.A.E.*, A **38** 162, etc.) and was recorded from Yugoslavia in 1951, was observed for the first time in Austria in the late summer of that year, when it was found in the neighbourhood of Vienna, in Burgenland and in parts of lower Austria. A list is given of plants of 45 species that were attacked by the larvae; they included many common fruit and shade trees, bushes, grape vine, cabbage, and weeds. Few young larvae were still present when observations were

made, and they formed communal webs round the leaves, which they skeletonised. In the later instars, they left the webs and dispersed over the plants, consuming all but the main veins of the leaves. Many trees were completely defoliated, and fruits were also attacked. During the second half of September, large numbers of larvae pupated in sheltered sites on or on the trees. No parasites were reared from larvae collected in the field. In preliminary laboratory experiments on control, in which larvae and food-plants or larvae only were treated, sprays of DDT, BHC (benzene hexachloride) and E 605 forte [an emulsion concentrate containing parathion] and dusts of DDT, BHC and E 605 Staub [2 per cent. methyl-parathion] all gave complete control of young larvae within 24 hours or less by both methods, the E 605 products being the most rapid in action. Older larvae were more resistant, and only the dusts gave complete kill. The mortality percentages for fully grown larvae seven days after treatment with E 605 Staub were 75 when larvae and food-plants were dusted and 50 for treatment of the larvae alone. The other materials gave inferior results.

CONRAD (F.) & CREMER (E.). **Über die Bestimmung der Haftkraft von Verstäubungsmitteln.** [On the Measurement of the Adhesiveness of Dusts.] —*Pflanzenschutzberichte* **7** pt. 11–12 pp. 190–195, 3 figs., 3 refs. Vienna, 1951. (With a Summary in English.)

The authors describe a simple apparatus devised for measuring the adhesiveness of dusts. It consists of a small platform that can be rotated to any angle from the horizontal. A large protractor scale rotates with it and from this the angle of inclination of the platform can be measured. A leaf, or any other material that it is desired to test as the substratum, is fixed to the platform and a quantity of the dust is spread evenly over the surface, with the platform at the horizontal position. It is then tilted slowly until the dust slides off in a mass, the angle of inclination is read from the scale, and the dust is weighed. The calculations necessary to obtain a value for adhesiveness in dynes are explained. The measurements should be repeated several times, with different weights of dust. The adhesiveness of talc and of several insecticidal dusts on glass, a metal, and a leaf surface measured in this way varied considerably according to the nature of the surface used. The results are compared with those obtained by the method of Görnitz [*R.A.E.*, A **15** 646].

BERAN (F.). **Auftreten und Bekämpfung des Kartoffelkäfers in Österreich im Jahre 1951.** [The Occurrence and Control of the Potato Beetle in Austria in 1951.]—*Pflanzenschutzberichte* **8** pt. 3–4 pp. 50–58, 1 map. (With a Summary in English.)

The potato beetle [*Leptinotarsa decemlineata* (Say)] increased its distribution in some of the provinces of Austria in 1951 and was found for the first time in Burgenland, but, as a result of unfavourable weather in the early summer and the control measures adopted, the intensity of infestation throughout the country was less than in 1950 [*R.A.E.*, A **40** 215] and the potato crop suffered no damage.

MCLEOD (J. H.). **Notes on the Lodgepole Needle Miner, *Recurvaria milleri* Busck (Lepidoptera : Gelechiidae), and its Parasites in western North America.**—*Canad. Ent.* **83** no. 11 pp. 295–301, 1 map, 3 refs. Ottawa, 1951.

The following is based on the author's summary. *Recurvaria milleri* Busck is becoming an increasingly important pest of lodgepole pine [*Pinus contorta*] in western North America. It was discovered in 1903 in the Yosemite National

Park, California [*cf. R.A.E.*, A **9** 391], where a population has persisted with irregular periods of abundance and scarcity. During 1942–50, three new areas of infestation were reported, two in Idaho and one in Alberta [**35** 59]. In California, the insect requires two years to complete its life-cycle, the moths emerging in odd-numbered years. In Alberta, it also requires two years, but moths normally emerge in even-numbered years ; in 1949, however, a considerable part of the population completed its development in one year. In Idaho, the insect completed its development in one year in each of the two years (1949–50) in which observations were made. Parasites of *R. milleri* are abundant in all areas, and in investigations in 1949–50 in which adults were reared from infested needles from Alberta, California and Idaho, the most abundant were *Copidosoma* sp., *Achrysocharoides* (*Neoderostenus*) sp., *Apanteles californicus* Mues., *Sympiesis* sp., *Zagrammosoma americanum* Gir., and *Dicladocerus* sp. All but the last, which was present in California and Idaho, occurred in all three areas. *Copidosoma* sp. has in the past been misidentified as *C. nanellae* Silv. [and recorded under that name in Oregon (**30** 265)].

Colonies of parasites were released in Alberta in 1949 and more extensively in 1950, when it was found that mortality in the preceding winter had reduced the parasite population. Those liberated in the latter year comprised 1,370 of *Apanteles*, 142 of *Dicladocerus*, 2,024 of *Achrysocharoides*, 29 of *Sympiesis*, and 1,616 of *Zagrammosoma*.

WALLEY (G. S.). **Notes on *Phanerotoma tibialis* (Hald.) and *P. fasciata* Prov., with Descriptions of two new Species (Hymenoptera : Braconidae).**— *Canad. Ent.* **83** no. 11 pp. 301–308. Ottawa, 1951.

The name *Phanerotoma tibialis* (Hald.) has been applied in North America to Braconids reared from Pyralids of the genera *Acrobasis* and *Tetralopha* and various Olethreutids, and the species has been regarded as unusually variable in colour and structure. From an examination of specimens, the author concludes that two species are involved, the hosts of which are Pyralids and Olethreutids, respectively. He gives the principal characters distinguishing them and considers that the one reared from Pyralids is *P. tibialis*, since all but four of the 33 specimens of it examined agreed with Haldeman's description in showing a dark spot behind the eye. In three of them, the spot was very faint, and these and the four from which it was absent were all from the southern United States ; the other usual dark markings on these seven and on six of eight other specimens from the same area were lighter than in specimens from Canada and Pennsylvania. The hosts from which *P. tibialis* has been reared are *A. caryae* Grote in Ontario, Florida, Illinois and Texas, *A. rubrifasciella* Pack. and *A. sylviella* Ely in Ontario, *A. carvivorella* Rag. in Texas, *Acrobasis* sp. in Arkansas, and *Tetralopha asperatella* (Clem.) in Quebec [*cf.* also *R.A.E.*, A **3** 532 ; **4** 174, 487]. Some evidence that its hosts may not be confined to Pyralids was provided by two specimens apparently reared from *Gretchena* (*Protocpteryx*) *deludana* (Clem.) in Texas. The distribution of *G. deludana* as given by Heinrich [**11** 398] does not include Texas, and the species has often been confused with *G. bolliana* (Sling.), which is a common pest of pecan in Texas and is often associated with *A. caryae*. If the parasites were reared from pecan-feeding larvae, they may therefore have been recorded from the wrong host.

The other species agreed with the type of *Phanerotoma fasciata* Prov. It is widely distributed and has been reared in the United States from *Cydia* (*Carpocapsa*) *pomonella* (L.) [**15** 149 ; **16** 434 ; **18** 279 ; **26** 30 ; **29** 193], *Enarmonia* (*Laspeyresia*) *caryana* (Fitch) [**5** 483 ; **18** 549], *C.* (*Melissopus*) *latiferreana* (Wlsm.) **29** 406 ; **31** 332], *C.* (*Grapholitha*) *molesta* (Busck) [**16** 134 ; **19** 43], *C.* (*G.*) *interstinctana* (Clem.) and *C.* (*G.*) *packardi* (Zell.), and in Canada from *C. pomonella* [**30** 111], *C. molesta*, *E. caryana*, *C. latiferreana* and *C.* (*L.*)

nigricana (Steph.) [**32** 263]. It has been introduced into New Zealand for liberation against *C. pomonella* [**22** 355 ; **23** 379].

The two new species described are *P. thapsina*, from Texas, and *P. longi[illegible]* which was reared from *Carposina* sp. in Virginia and is widely distributed in the United States and Canada.

BOYCE (H. R.) & LEROUX (E. J.). **A Note on Dipterous Predators of the European Red Mite,** *Metatetranychus ulmi* **(Koch).**—*Canad. Ent.* **83** no. 12 p. 332. Ottawa, 1951.

In late August and early September 1950, adult Dolichopodids identified as *Condylostylus sipho* (Say), *Laxina nigrofemoratus* (Wlk.), and *Diaphorus* or *Chrysotus* sp. were observed feeding on adults of *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi* (Koch)) on the leaves of apple in Ontario.

MUSGRAVE (A. J.) & MILLER (J. J.). **A Note on some preliminary Observations on the Effect of the Antibiotic Terramycin on Insect symbiotic Micro-organisms.**—*Canad. Ent.* **83** no. 12 pp. 343–345, 13 refs. Ottawa, 1951.

Micro-organisms that appear to be symbiotic occur in many insects, often in special organs known as mycetomes, and may be of considerable importance to their hosts [*R.A.E.*, B **22** 232 ; **32** 234]. Mycetomes are present in both *Calandra* (*Sitophilus*) *granaria* (L.) and *C.* (*S.*) *oryzae* (L.), but micro-organisms occur apparently only in the latter ; their value to it is therefore open to question, and was accordingly investigated. The presence of micro-organisms in the mycetome, mid-gut coeca and ovarioles of *C. oryzae* was confirmed visually, and it was thought that their absence in *C. granaria* would be demonstrated if differential effects were produced in the metabolism of the two species by the administration of an antibiotic.

Small samples of wheat grains of uniform size [*cf.* A **34** 297] in small glass vials were soaked in aqueous acidified solutions of terramycin hydrochloride at the very high rate of 0·036 gm. terramycin per gm. grain, dried at 40–50°C. [104–122°F.], and then infested with weevils of a given species ; for the control experiments, the wheat was soaked in acidified water. The cultures were kept at about 26–27°C. [78·8–80·6°F.] and 76 per cent. relative humidity, and counts of adults were made after 72 days. The approximate mortality of *C. oryzae* and *C. granaria* in the treated grain was then 84 and 32 per cent., respectively, whereas it was only 11 in the controls of both species. The control populations of the two species had increased, respectively, to about four and about three times their original size, but treated populations of *C. oryzae* had increased by only 20 per cent. and those of *C. granaria* by slightly more than 100 per cent. Less of the treated than of the untreated grain was eaten by both species, but the reduction was considerable in cultures of *C. oryzae* and only slight in those of *C. granaria*. The same trends were apparent after a further 40 days, and also in another experiment in which lower doses of terramycin were used. It is suggested that antibiotics might be of value in the control of insects such as Aphids and some wood-eating beetles that possess mycetomes.

BRYGIDER (W.). **In what embryonic Stage do the Eggs of** *Neodiprion* **enter the Winter Diapause ?**—*Canad. J. Zool.* **30** no. 2 pp. 99–108, 2 pls., 2 figs., 8 refs. Ottawa, 1952.

Microscopic examination of overwintering eggs of *Neodiprion banksianae* Rohw., *N. nanulus* (Schedl), and *N. sertifer* (Geoffr.) in pine needles in Canada showed that all three species overwinter as a well-developed embryo with distinct segmentation, differentiated germ layers and rudiments of coelom enclosed within the amniotic cavity. There are differences in details of structure.

however, and in the position of the egg in the needle, though in each case the embryo is situated on the side of the egg nearest the middle of the needle. The eggs and embryos and the technique used are described.

WELLINGTON (W. G.). **Air-mass Climatology of Ontario north of Lake Huron and Lake Superior before Outbreaks of the Spruce Budworm, *Choristoneura fumiferana* (Clem.), and the Forest Tent Caterpillar, *Malacosoma disstria* Hbn. (Lepidoptera : Tortricidae ; Lasiocampidae).**—*Canad. J. Zool.* **30** no. 2 pp. 114–127, 3 figs., 4 refs. Ottawa, 1952.

The following is virtually the author's summary. Previous work in eastern Canada [*R.A.E.*, A **39** 151] showed that ideal physical conditions for the development of the spruce budworm, *Choristoneura fumiferana* (Clem.), occur when the weather is relatively dry and clear. These conditions have tended to occur in summers when the annual number of cyclonic centres passing over the area was declining, and have preceded past outbreaks. On the other hand, the physical requirements of *Malacosoma disstria* Hb. include warm, humid, cloudy weather during much of the larval stage, and outbreaks of this species in Ontario have begun after an increase in the annual number of cyclonic passages. While the annual number of cyclonic passages is declining in periods before outbreaks of *C. fumiferana* in northern Ontario, the number of these passages in the summer months falls below average. Furthermore, the majority of the centres that do pass in these months contain air masses of polar continental or maritime origin. The more humid south-western air masses are usually barred from the area by a southward shift of the whole circulation pattern. This situation is reversed in periods before outbreaks of *M. disstria*. While the annual number of passages is increasing, the number occurring in the summer months is above average, as is the proportion of south-western air masses occurring in these months. Northern and western air masses are usually active farther north, owing to a northward shift of the whole circulation pattern.

HENSON (W. R.) & SHEPHERD (R. F.). **The Effects of Radiation on the Habitat Temperatures of the Lodgepole Needle Miner, *Recurvaria milleri* Busck (Gelechiidae : Lepidoptera).**—*Canad. J. Zool.* **30** no. 2 pp. 144–153, 1 graph, 4 refs. Ottawa, 1952.

Work on the influence of climatic factors on insects was begun in the Rocky Mountains in Alberta and British Columbia in 1950 as part of an investigation of problems relating to the forest pests of the area. The following is substantially the authors' summary of studies in British Columbia in 1951 on the relation of ambient air temperature, radiation and other factors to the temperature in the mines made by *Recurvaria milleri* Busck in the needles of lodgepole pine [*Pinus contorta*]. Incoming solar radiation shows a heating effect on the mines that is directly proportional to the radiation level. The heating effect of the radiation is modified by other weather factors, by differences in the exposure of the needles, and by the types of mines in the needles. At night, needles are cooled below ambient air temperatures by outgoing radiation, which in turn is dependent on the nocturnal weather. The application of these results to studies of the effect of temperature on the miner can only be made with respect to individual needles. Thus, radiation of 1·5 gm.-cal. per sq. cm. per minute will elevate the temperature of a needle by 6·3°C. [11·34°F.] in air moving at less than one mile per hour if the needle is orientated at right angles to the sun and fully exposed. Shade from other needles, wind speeds exceeding one mile per hour, and needle orientation other than 90° to the rays of the sun all tend to reduce the amount of heating at the indicated level of radiation.

CHURCH (N. S.) & SALT (R. W.). **Some Effects of Temperature on Development and Diapause in Eggs of *Melanoplus bivittatus* (Say) (Orthoptera : Acrididae).** —*Canad. J. Zool.* **30** no. 3 pp. 173–184, 6 graphs, 2 refs. Ottawa, 1952.

Under favourable conditions, most eggs of *Melanoplus bivittatus* cease development at a stage corresponding to that reached after incubation for 21 days at 25°C. [77°F.], with abundant moisture, and enter diapause ; this is broken by winter cold, and development is resumed in spring. Cold weather in late autumn, sometimes combined with dryness, often stops development at an earlier stage, and the potential for diapause is then broken. Earlier tests showed that exposure to cold was the only means by which the elimination of diapause could be hastened, and the most effective temperature for this purpose was 5°C. [41°F.]. Further investigations were made in 1948–51 on the effects of moderate temperatures on diapause and development. When diapause is broken, eggs kept at 25°C. normally hatch in 6–25 days, with a peak after 10–13 days. Eggs that had completed 16 days' development and were then stored at 2–4°C. [35·6–39·2°F.] for a month to avert the diapause were kept at 10, 15, 20 or 25°C. [50, 59, 68 or 77°F.] until hatching was complete. The results showed that development after blastokinesis was directly proportional to temperature but was only partial at 10°C., leading to abnormal embryos. When the eggs were allowed to incubate for a further nine days before treatment, many that were not far from hatching completed development at 10°C., but only about half of them hatched. By extrapolation, 12°C. [53·6°F.] was found to be the theoretical threshold of normal development. In other tests, it was found that development and hatching can take place at 5°C. in eggs that have completed diapause and in those in which it has been averted, but that it is limited in extent.

The proportion of eggs that do not enter diapause varies greatly from season to season ; eggs of both types occur in the same egg pod. In eggs in which diapause occurs, it may persist for only a few days or for more than 100 at 5°C., and its duration varied from year to year among eggs laid in the greenhouse. Prolonged exposure to 25°C. before cold treatment reduced the period at low temperature necessary to break the diapause, but the total development period of the egg was then longer. Experiments in which eggs were kept at temperatures of 5 and 25°C. on alternate days indicated that there was no marked difference in the ease with which diapause could be broken in embryos of different ages ; frequent temperature changes appeared to hinder both the breaking of diapause and morphogenesis.

It is pointed out in a discussion of these results that the relations of temperature with the elimination of diapause and with morphogenesis should be considered separately, since the optimum temperatures for these processes differ by more than 20°C. [36°F.]. The theoretical threshold of temperature for the whole period of katatrepsis was 12°C., but many processes take place at temperatures as low as 5°C., although higher ones are more favourable. The threshold temperature is therefore regarded as a minimum temperature at which most of the embryos undergo all the processes of development and hatching.

MONRO (H. A. U.). **Insect Pests in Cargo Ships.**—*Publ. Dep. Agric. Can.* no. 855, 45 pp., 1 fldg. pl., 25 figs., 9 refs. Ottawa, 1951.

Large populations of injurious insects and mites develop in accumulations of débris left in the holds of ships used for the transport of food commodities and provide a source of infestation for subsequent cargoes. This is especially undesirable in the case of wheat from Canada, where considerable care is taken to ensure that the grain is not infested before shipment. The author discusses the more important sites of infestation in the holds of ships, sources of infestation, the appearance, habits and importance of the common insects that are

found in holds prior to loading, the frequency of occurrence of the more important pests observed in those ships in Canadian ports, and preventive and control measures, with instructions for applying them. In a concluding section, the Canadian legislation relating to the inspection of ships awaiting cargoes of grain or cereals is cited, the inspection procedure at Canadian ports is described, and the recognised standards of insect infestation in ships' cargo spaces, with the appropriate treatment for each, are shown in a table.

The preventive measures comprise the modification of certain structural features that encourage infestation, the maintenance of the hold in good repair, and scrupulous attention to cleanliness. Control measures comprise treatment of the empty hold with DDT aerosols or with sprays containing pyrethrum, benzene hexachloride, chlordan or DDT, which has proved very effective at 5 per cent. and leaves a toxic residue that is long-lasting, or fumigation with hydrocyanic acid gas or methyl bromide [*cf.* next abstract]. HCN is applied by distributing crude paper disks impregnated with liquid HCN, which vaporises rapidly. At temperatures above 60°F., a dosage of at least 8 oz. per 1,000 cu. ft. space and an exposure period of ten hours is required, and observations in Canada indicate that the best results are given by a dosage of 10–12 oz. per 1,000 cu. ft. and exposure for 12 hours. Between 40 and 60°F., freely exposed insects have been controlled satisfactorily by HCN, but the gas does not readily penetrate under boards and into crevices or give complete mortality of immature stages within grain kernels at such low temperatures. Methyl bromide is most suitably applied from cylinders containing 10, 50 or 100 lb. liquid fumigant with the addition of compressed air to assist its propulsion through tubes or piping. At temperatures of 60°F. and over, exposure to a dosage of 1 lb. per 1,000 cu. ft. space for ten hours effects control. Satisfactory results can be obtained at temperatures as low as 30°F., provided that a fan is used, but the exposure period must be increased to 12 hours below 60°F. and the dosage to 1½ and 2 lb. at 40–49 and 30–39°F., respectively.

Used bags forming dunnage are a common source of infestation and should also be fumigated. Vacuum fumigation with HCN or methyl bromide is advisable to ensure complete mortality of all insect stages in bales of pressed bags, but loosely piled bags can be treated by fumigation with methyl bromide at atmospheric pressure at a concentration of 1–1½ lb. per 1,000 cu. ft. for 16–24 hours at temperatures of 60°F. or over.

MONRO (H. A. U.), CUNNINGHAM (C. R.) & KING (J. E.). **Hydrogen Cyanide and Methyl Bromide as Fumigants for Insect Control in empty Cargo Ships.**—*Sci. Agric.* **32** no. 5 pp. 241–265, 2 figs., 17 refs. Ottawa, 1952.

Fumigation with hydrocyanic acid gas has been used in Canada to free the holds of ships from injurious insects prior to loading with wheat or cereal products, but has not always given satisfactory results and has led to subsequent complaints by stevedores of persistent odours, although the residues of the gas were well below the limit of danger. The use of methyl bromide was therefore introduced in 1948, and its effectiveness, safety and general suitability for the purpose were compared with those of HCN under practical conditions during spring, summer and autumn at Montreal and in winter at Vancouver. HCN was applied by the disk method and methyl bromide under pressure from cylinders [see preceding abstract]. For reasons of safety, the maximum dosage of HCN was limited to 12 oz. per 1,000 cu. ft. for an exposure period of 12 hours; methyl bromide was applied at rates of 0·5–2 lb. per 1,000 cu. ft. for 10–12 hours according to temperature.

Observations were made in nearly 50 ships on test insects, comprising different stages of *Calandra* (*Sitophilus*) *granaria* (L.) and *Tenebroides mauritanicus* (L.), that were placed in capsules in various parts of the holds before fumigation with HCN or methyl bromide began and were returned to the laboratory after

exposure. These showed that, under normal conditions, effective insecticidal concentrations became evenly distributed throughout a hold, but if no special means, such as circulating fans, were provided for the initial distribution of methyl bromide, it settled in a layer at the bottom. Methyl bromide was more effective than HCN against all stages of *C. granaria*, but had to be applied at a higher dosage at temperatures below 60°F. [*loc. cit.*]. Under all conditions, HCN was more effective than methyl bromide against *T. mauritanicus*.

Over 300 ships were treated with HCN or methyl bromide between April 1947 and March 1950. All were subjected to rigorous inspection after fumigation and those that returned to Canadian ports were again examined. The histories of 15, of which six were fumigated with HCN and nine with methyl bromide, are described, and it is concluded that either fumigant is effective if properly applied. The comparative failure of HCN against some stages of *C. granaria* observed among the test insects and its superiority over methyl bromide against *T. mauritanicus* were less apparent with natural populations. Each fumigant was effective at low temperatures, the lowest tested being 37°F. for HCN and 29°F. for methyl bromide. Although methyl bromide is a comparatively heavy gas, it was easily removed from the empty holds, especially with the aid of a blower. Its lack of odour proved an advantage, since workers entered the holds after aeration without anxiety.

It is pointed out that although fumigant dosage is conveniently expressed as pounds per 1,000 cu. ft. for practical purposes, such expressions in terms of weight per volume do not provide a true basis for the comparison of the effectiveness of different gases. Comparison should be made in terms of the relative number of molecules employed, and this is provided by the expression of gas concentrations as percentage by volume of the fumigant in air.

WALL (A.). **The Diameter of the Wheat Stem in Relation to the Length and Sex of emerging Sawfly (*Cephus cinctus* Nort.).**—*Sci. Agric.* **32** no. 5 pp. 272–277, 4 refs. Ottawa, 1952.

The relations between the width (assessed as external diameter) of wheat stubs infested by *Cephus cinctus* Nort. and the length of the females and the sex ratio among the adults that emerge from them were studied in three resistant and three susceptible varieties of wheat grown at three places in Canada [*cf. R.A.E.*, A **35** 338]. Varietal differences were found both in the length of emerging females and in stem diameters, but there were no significant differences due to locality. The correlation coefficients between the lengths of the females and the diameters of the stubs from which they emerged were highly significant for two of the resistant and two of the susceptible varieties, significant for the third susceptible one and not significant for the remaining resistant one. The average widths of stubs from which males and females emerged were 2·4 and 2·6 mm., respectively; the difference was statistically significant, and there were significant excesses of females over males from large stems and of males over females from small ones, as compared with a theoretical sex ratio of 1 : 1.

It is concluded that the length of the females and, in consequence, their fecundity, which has been shown to be directly related to it, are influenced within a variety by the size of the stems in which they develop, but that less than 20 per cent. of the variability in length can be attributed to this factor. The findings with regard to the sex ratio support a hypothesis of A. J. McGinnis that the size of the stem in which the female oviposits determines whether the eggs are fertilised or not and hence, presumably, the sex of the individuals to which they give rise, but could also be explained on the assumption that small stems, which usually mature late, are in general infested last, when the supply of spermatozoa may be exhausted or nearly so.

HAGEDORN (D. J.) & WALKER (J. C.). **Wisconsin Pea Stunt, a newly described Disease.**—*J. agric. Res.* **78** no. 12 pp. 617–626, 4 figs., 4 refs. Washington, D.C., 1949.

The authors describe the circumstances in which the virus of Wisconsin pea stunt was discovered in that State in 1946 and the tests in which it was transmitted in the laboratory by *Macrosiphum pisum* Harr. (*Illinoia pisi* (Kalt.)) [*cf. R.A.E.*, A **39** 323] and record observations on its physical properties, the symptoms that it causes in the field and greenhouse, its host range and varietal susceptibility in peas.

MEDLER (J. T.) & THOMPSON (H. E.). **Toxicity Studies of DDT-Sabadilla Mixtures with Evidence of synergistic Action.**—*J. agric. Res.* **78** no. 12 pp. 641–646, 3 graphs, 3 refs. Washington, D.C., 1949.

To test the apparent synergistic action between DDT and sabadilla observed when they were used in dusts against insects on lucerne [*cf. R.A.E.*, A **37** 209], laboratory tests were carried out in Wisconsin with suspensions containing 4·8, 2·4, 1·2 and 0·6 gm. 50 per cent. DDT or 50 per cent. lime-activated sabadilla [**34** 301] per litre and mixtures of each concentration of DDT with each of sabadilla. They were applied in a spray tower to petri dishes, in which insects were subsequently confined, and the times required for 50 per cent. knockdown were determined. Adults of *Musca domestica* L., reared in the laboratory, were tested within two hours of spraying and after intervals of 5, 10, 20 and 30 days, and field-collected adults of *Lygus oblineatus* (Say) and *Adelphocoris lineolatus* (Goeze) immediately and after one week.

Statistical analysis showed that the toxicity of DDT to *M. domestica* was proportionately increased by the addition of sabadilla, though DDT was the major toxicant in each combination; 0·6 gm. DDT showed a loss of effect after five days when used alone, but gave knockdown after ten days when sabadilla was added, 1·2 gm. DDT, alone and with sabadilla, was effective after ten days but not later, and 2·4 and 4·8 gm. DDT showed no loss after 30 days. The last apparently gave higher knockdown after 30 days than immediately, possibly owing to the gradual dissipation of some masking agent in the inert ingredients of the wettable powder

In tests against the two Mirids, sabadilla was the major toxicant in mixtures. It lost most of its effectiveness in a week, but 4·8 gm. DDT gave a quicker knockdown with 0·6 gm. sabadilla than alone after a week, suggesting some residual effect of sabadilla at certain concentrations. Equivalent concentrations of DDT were more toxic to nymphs than to adults of *L. oblineatus*, and this species was less resistant than *A. lineolatus* to 2·4 gm. DDT with 1·2 gm. sabadilla.

The data obtained indicate synergism between the two compounds, since the effect of the mixtures was greater than the joint effect predictable from the individual action, and practical use of these results may be made in the field by preparing mixtures of sabadilla that give high initial toxicity with decreased amounts of DDT; this may be particularly important when DDT is used for the treatment of forage crops, on which there is a danger of injurious residues.

BENNETT (C. W.) & COSTA (A. S.). **The Brazilian Curly Top of Tomato and Tobacco resembling North American and Argentine Curly Top of Sugar Beet.**—*J. agric. Res.* **78** no. 12 pp. 675–693, 5 figs., 10 refs. Washington, D.C., 1949.

The following is based on the authors' summary. Evidence is presented indicating that the rugose form of a disease of tobacco known as "encarquilhamento da fôlha" and a disease of tomato described by Sauer [*cf. R.A.E.*, A **36** 77], both of which occur in São Paulo, Brazil, are caused by the same

virus. It was also found in buckwheat (*Fagopyrum esculentum*) and in spiny bur (*Acanthospermum hispidum*), a common weed of cultivated fields, and was transmitted to a wide range of plants, including tobacco, tomato, spinach, sugar beet, flax, jimsonweed (*Datura stramonium*), buckwheat, spiny bur, *Oxalis*, *Zinnia* and chickweed (*Stellaria media*), by the Jassid, *Agallia albidula* Uhl. The symptoms on these plants are very similar to those produced by the sugar-beet curly-top virus in the United States, but sugar beet is more resistant to infection and much less severely injured by the Brazilian virus. The latter was transmitted by grafting but not by sap inoculation.

A. albidula has a wide range of food-plants, breeding well on potato, common purslane (*Portulaca oleracea*), pigweed (*Amarantus retroflexus*), jimsonweed, aster (*Callistephus*), lettuce, common nightshade (*Solanum nigrum*), spinach and spiny bur, of which the last is probably one of the important breeding plants in nature and one of the important sources of virus for crop plants. The Jassid apparently cannot breed on tomato, tobacco or sugar beet. Evidence of infection after short successive transfers of infected individuals of *A. albidula* to healthy seedlings of buckwheat indicated that the virus becomes exhausted from certain insects, though only after considerable periods, that its incubation period in the Jassid is 24 hours or more and that the infectivity of the insects increases for at least 48 hours after infection. Viruliferous individuals varied considerably in their ability to transmit the virus, some retaining it for up to 85 days when feeding on plants found immune from the disease. The progeny of these insects reared on the immune plants did not transmit the disease, indicating that the causal virus is not transmitted through the egg of the vector. The virus was precipitated from the juice of spinach in 50 per cent. alcohol and recovered by non-viruliferous Jassids that fed on a suspension of the alcoholic precipitate.

Because of the similarity in host range and in symptoms on various plants, it is thought that this virus is related to the sugar-beet curly-top virus of the United States (now known as *Ruga verrucosans* in the system of Holmes [*cf.* **34** 380]) and to the curly-top virus of Argentina (*R. verrucosans* var. *distans*) and should be classified as a variety of the curly-top virus complex of the Western Hemisphere. The name *R. verrucosans* var. *brasiliensis* is suggested for it.

FLANDERS (S. E.). **Mass Culture of California Red Scale and its Golden Chalcid Parasites.**—*Hilgardia* **21** no. 1 pp. 1–42, 22 figs., 18 refs. Berkeley, Calif., 1951.

The author describes a method of mass culture of *Aonidiella aurantii* (Mask.) and its Aphelinid parasite, *Aphytis chrysomphali* (Merc.), developed in California. It is substantially similar to one already noticed [*R.A.E.*, A **39** 236], but several modifications have been adopted to render it more economic. The method has proved equally applicable to the culture of the species referred to as *Aphytis* A [*cf.* **39** 235], which reproduces under a wider range of environmental conditions, but has the disadvantage of producing about as many males as females.

CLEMSON (F.), MILLER (L. P.) & WEED (R. M.). **An Estimate of the Quantity of oral Secretion deposited by *Lygus* when feeding on Bean Tissue.**—*Contrib. Boyce Thompson Inst.* **16** no. 9 pp. 429–433, 1 fig., 2 refs. Menasha, Wis., 1952.

In the experiments described the quantity of saliva injected by *Lygus oblineatus* (Say) into bean tissue during feeding was determined by the use of radioactive phosphorus (P^{32}). Adults were fed on sucrose solutions containing large amounts of P^{32} [*cf.* *R.A.E.*, A **40** 156] until they had taken up amounts

equivalent to about 500,000 counts per minute, and after a precautionary period, transferred to bean tissue prepared as previously described [*cf. loc. cit.*]. Saliva was collected from them with a micropipette under the microscope as soon as possible after feeding. From the radioactivity per unit volume of the saliva and the radioactivity of the bean tissue, it was calculated that volumes of 0·038–0·251 mml. saliva were injected in feeding periods of about 20–108 minutes, but the amount of activity imparted was not directly associated with the length of the feeding period. The insects are apparently not necessarily feeding during the whole time that the proboscis is inserted into the plant tissue.

FRANKLIN (H. J.). **Cranberry Insects in Massachusetts.**—*Bull. Mass. agric. Exp. Sta.* no. 445 (suppl.), 15 pp., 11 figs., 3 refs. Amherst, Mass., 1952.

This supplement to a bulletin already noticed [*R.A.E.*, A **40** 225] contains a few modifications of treatments against cranberry insects and records of four new pests. These are the Coccids, *Eriococcus azaleae* Comst., *Hemiberlesia lataniae* (Sign.) and *Eulecanium* (*Lecanium*) sp., and the Psychid, *Fumaria* (*Fumea*) *casta* (Pall.), all of which were observed on cranberry in 1951.

RODRIGUEZ (J. G.). **Mineral Nutrition of the Two-spotted Spider Mite, *Tetranychus bimaculatus* Harvey.**—*Ann. ent. Soc. Amer.* **44** (1951) no. 4 pp. 511–526, 31 refs. Columbus, Ohio, 1952.

Experiments were carried out in Ohio to ascertain the influence of single minerals and of combinations of minerals on the development of populations of *Tetranychus bimaculatus* Harvey on tomato [*cf. R.A.E.*, A **38** 111]. The plants were grown in nutrient salt solutions in which the concentration of one of the major elements (nitrogen, phosphorus, sulphur, magnesium, potassium and calcium) at a time was varied, and the mites were allowed to develop on isolated leaflets. The leaflets were analysed to determine the amounts of minerals absorbed, and the effect of quantity of mineral supplied and quantity absorbed on the number of progeny developing over a given period of time ascertained. The supply of minor elements was not varied.

The results indicated that mite populations increase when the medium contains concentrations of salts superfluous for normal plant growth, and that when the concentration of all the major elements was doubled in the nutrient solution, the mites produced twice the number of progeny. Variations in the supply of individual major elements caused wide fluctuations in the absorption of minor ones, and some significant relations with mite populations were detected.

FERNANDO (H. E.), ROAN (C. C.) & KEARNS (C. W.). **The Penetration and Metabolism of organic Phosphates in the American Roach, *Periplaneta americana* (Linn.).**—*Ann. ent. Soc. Amer.* **44** (1951) no. 4 pp. 551–565, 1 fig., 17 refs. Columbus, Ohio, 1952.

In further investigations on the fate of organic phosphates in *Periplaneta americana* (L.) [*cf. R.A.E.*, A **39** 13], radioactive TEPP (tetraethyl pyrophosphate), diethyl phosphoric acid, tetra-n-butyl pyrophosphate, paraoxon (diethyl-p-nitrophenyl phosphate) and parathion were dissolved in acetone and administered to adults of both sexes by topical application to the cervical membrane or by mouth with a microsyringe. Quantitative data on the concentrations of the compounds in the tissues and blood after various periods were obtained by assay with a counter, and radioautographs were used to study the gross distribution of TEPP after topical application. The method of preparing them, which is suitable for use with compounds soluble in water and in the organic solvents used in the preparation of tissues for microtomy, is described.

The radioautographs showed that the heaviest concentration of TEPP was in the crop and that lower ones were present in the midgut and gastric caeca. Vague traces were detected in the fat-body, muscles and hindgut, but none in the ovaries or thoracic or cerebral ganglia, and it is concluded that the crop selectively concentrates most of the TEPP from the blood, the passage of the compound down the alimentary canal being very slow. The Malpighian tubes did not take up any appreciable quantity from the blood, and the amount entering the central nervous system was too small to cause a perceptible darkening of the film used.

The assays with the counter showed that the blood is the chief medium of transmission of all the compounds in the body. Topically applied paraoxon penetrated extremely rapidly, 51 and 92 per cent. of the dose of 5 mmg. having entered the insect after 10 and about 30 minutes, respectively ; concentration by the crop was rapid and selective, and the amount entering the central nervous system was small (0·025 mmg. after 30 minutes), but probably much more than that required for cholinesterase inhibition. Parathion was much slower in penetration and distribution ; the concentration was greatest in the crop, but much lower than for paraoxon, and the rate of accumulation in the central nervous system was very slow indeed (0·017 mmg. after 4 hours) ; this may explain the slower action of parathion. Diethyl phosphoric acid and tetra-n-butyl pyrophosphate, which are not toxic to *P. americana*, and TEPP all followed the same general pattern of distribution as parathion and paraoxon. Diethyl phosphoric acid entered the central nervous system in about the same amounts as the other compounds, and this throws doubt on theories that it is responsible for the action of phosphate esters on enzyme systems [*cf.* **37** 214]. Studies *in vitro* showed that diethyl phosphoric acid did not inhibit cholinesterase.

Doses of 40 mmg. TEPP can be administered orally without the appearance of any toxic symptoms in over 95 per cent. of the cockroaches, whereas doses of 5 mmg. parathion or paraoxon evoke toxic symptoms as rapidly as a topically administered dose of the same size. All three compounds showed a progressive decrease in concentration in the crop and a gradual increase in the midgut and hindgut, but TEPP entered the blood stream more slowly than the others, and the radioactive material in the blood of a cockroach treated orally with TEPP did not inhibit cholinesterase and had probably been metabolised to diethyl phosphoric acid. The rapid diffusion of parathion and paraoxon from the crop resulted in lethal accumulations in the vulnerable tissues before any detoxifying mechanism could operate. An average of only 0·0006 mmg. of the 0·025–0·03 mmg. paraoxon that has entered the central nervous system by the knockdown time after topical application is apparently used in the inhibition of cholinesterase. Further tests showed that the inhibitory activity of TEPP was not lost in either the blood or the foregut. Water extracts of excreta from insects that received sublethal topical applications of TEPP failed to inhibit rat-brain cholinesterase, so that the decomposition of TEPP probably occurs after it leaves the foregut and before it is voided with the excreta. Similar tests with insects that had ingested TEPP 24 hours previously showed that material in the gut inhibited cholinesterase, whereas that in the blood did not.

DICKSON (R. C.). **Construction of the Scale Covering of *Aonidiella aurantii* (Mask.).**—*Ann. ent. Soc. Amer.* **44** (1951) no. 4 pp. 596–602, 2 figs., 6 refs. Columbus, Ohio, 1952.

Aonidiella aurantii (Mask.) constructs its covering from its cast skins and material secreted in the form of filaments by the glands in the pygidium. The covering is shaped by the action of the pygidium itself. As the insect moves with an irregular circling motion and the material is deposited at random, the edge is much thinner than any other part. Spray oil probably penetrates through this

edge rather than under it [*cf. R.A.E.*, A **24** 779–780], since the covering is tightly sealed to the surface. Scale coverings were found to consist of about 8 per cent. exuviae, 45 per cent. waxes and 47 per cent. secreted proteinaceous material by weight. The pure wax melted at 86–88°C.

FENNAH (R. G.). **New Genera and Species of Neotropical Cercopoidea (Homoptera).**—*Ann. Mag. nat. Hist.* (12) **1** (1948) no. 9 pp. 605–620, 5 figs. London, 1949. **Autecological Notes on three Species of *Aeneolamia* (Homoptera : Cercopoidea).**—*Op. cit.* (12) **2** no. 21 pp. 703–726, 11 figs., 1 ref. 1949.

In the first paper, the new genera *Prosapia*, *Deois*, *Aeneolamia*, *Phytozamia*, *Delassor*, *Vorago* and *Zulia* are erected for the neotropical froghoppers hitherto included in *Tomaspis*. Most of those injurious to sugar-cane are included in *Aeneolamia*, though *T. guppyi* Urich [*cf. R.A.E.*, A **27** 543] and *T. mura* China & Myers [**23** 396] are referred to *Delassor*, and *T. morialis* China & Myers [**23** 396] to *Deois*. *Delassor tristis* (F.) subsp. *monagasi*, n., is described from sugar-cane and *Panicum maximum* in Venezuela, and new species of *Vorago* and *Zulia* are also described.

From the material available to him, the author recognises six species of *Aeneolamia*, of which *varia* (F.), *flavilatera* (Urich), *postica* (Wlk.), *lepidior* (Fowl.) and *reducta* (Lall.) include phenotypes or subspecies, and *selecta* (Wlk.) is a fairly isolated phenotype.

The second paper includes notes on the characters of the typical subspecies of *Aeneolamia varia* and *A. flavilatera*, and of *A. varia* subsp. *saccharina* (Dist.). *A. f. flavilatera* and *A. v. saccharina* are the subspecies of British Guiana and Trinidad, respectively, that have been known as *T. flavilatera* and *T. saccharina*. *A. reducta* subsp. *montana*, n., four new subspecies of *A. flavilatera*, and 13 subspecies of *A. varia*, of which nine are new and ten were sometimes found on sugar-cane, are described from Venezuela. One of these subspecies, *A. v. bodkini* (Williams), also occurs in British Guiana.

Genetic changes in local populations of *A. varia* and the way in which some have become adapted to the "savannah" conditions typical of sugar-cane fields by aestivating in the egg stage [*cf.* **19** 457 ; **27** 543] are discussed.

GAHAN (A. B.). **Identity of the *Anagyrus* that parasitizes the Pineapple Mealybug (Hymenoptera : Chalcidoidea : Encyrtidae).**—*Proc. Hawaii. ent. Soc.* **13** no. 3 pp. 357–360. Honolulu, 1949.

The species of *Anagyrus* that was reared from *Pseudococcus brevipes* (Ckll.) in Brazil and introduced under the name *A. coccidivorus* Doz. into Hawaii [*cf. R.A.E.*, A **37** 80, etc.] and Porto Rico [*cf.* **26** 329 ; **28** 523 ; **32** 342, etc.] has been found not to reproduce in *Ferrisiana* (*Ferrisia*) *virgata* (Ckll.), the host from which *A. coccidivorus* was originally described [*cf.* **20** 222], and to show slight but constant differences from the type of the latter and from the other known species of the genus. It is therefore described, as *A. ananatis*, sp. n., from 81 females and 5 males reared from *P. brevipes* in Brazil or Hawaii. Characters distinguishing the very similar *A. lactylopii* (How.) from it are described and reasons are given for considering *A. subalbicornis* (Gir.) [*cf.* **12** 588] and *A. ferrisi* Comp. [*cf.* **14** 580] synonyms of *A. vuccae* (Coq.), and *A. flavus* Ishii [*cf.* **18** 258] a synonym of *A. schönherri* (Westw.).

BOX (H. E.). **The more important Insect Pests of Sugar Cane in northern Venezuela.**—*Proc. Hawaii. ent. Soc.* **14** no. 1 pp. 41–51, 2 maps, 4 refs. Honolulu, 1950.

The author describes the distribution of sugar-cane cultivation in Venezuela [*cf. R.A.E.*, A **37** 273] and gives short accounts of the occurrence and economic

importance of the insects that attack the crop in any of the localities concerned, with records of their natural enemies.

Most of the information on the Pyralids, *Diatraea saccharalis* (F.), *D. impersonatella* (Wlk.), *D. canella* Hmps., *D. busckella* Dyar & Heinr. and *D. rosa* Heinr., and their parasites has already been noticed [*cf.* **37** 273; **39** 93]. The latter include the egg parasite, *Trichogramma minutum* Ril. (*evanescens*, auct.), which is widespread, and a Tachinid considered by F. van Emden to be close to *Zenillia ochracea* Wulp, which is local and rare. *Castnia licoides* Boisd. is common on sugar-cane only at two places in Carabobo State, but may be of considerable potential importance; larvae of *Castnia* sp., possibly *C. licoides*, have been found in Táchira and at Upata, south of the Rio Orinoco. No natural enemies have been observed, but *Zenillia palpalis* Aldr., which occurs as a parasite of *Diatraea*, was originally reared from *C. licoides* in British Guiana [*cf.* **39** 93].

Adults of several species of *Lachnosterna* are sometimes abundant near the sugar estates, but the larvae are not important, and the only injurious Lamellicorn present is the Dynastid, *Podischnus agenor* (Ol.), which is common from Sucre to Táchira and has sometimes caused heavy damage in Carabobo; it appears recently to have become established in the important cane zones of the Turbio and Tocuyo valleys (Lara). The larvae normally occur in soils over-rich in decomposing vegetable matter and rarely feed on living plant tissue. The adults appear in large numbers at the beginning of the rainy season (April–May) and burrow into the cane stalks. The only parasite observed is *Campsomeris servillei* (Guér.), which occurs from Monagas State to Merida. *P. horni* Sternb. was collected on one sugar estate in Táchira, but its status is not known. The weevil, *Metamasius hemipterus* (L.), is found in nearly every sugar-cane area; its attacks usually follow those of *Diatraea*, but it occasionally causes serious damage.

Saccharicoccus (*Trionymus*) *sacchari* (Ckll.) is one of the most widely distributed pests and occasionally causes severe injury, especially during the dry season, on small isolated farms on which the fields have been neglected. Outbreaks are localised and accompanied by large numbers of ants. On the larger estates and plantations, the Coccid appears to be adequately controlled by native predators, of which *Hyperaspis trilineata* Muls. appears to be the most important. *Sipha flava* (Forbes) is also widely distributed but only occasionally injurious. The worst damage occurs in fields of young plant canes, the development of which may sometimes be seriously impeded, and appears to be associated with poor agricultural conditions and with the occurrence of root diseases. The Aphid is commonly attacked by larvae of Coccinellids, particularly *Cycloneda sanguinea* (L.) and *Ceratomegilla* (*Coleomegilla*) *maculata* (Deg.), and Chrysopids. *Aphis maidis* Fitch is apparently rare, but mosaic disease, of which it is a well-known vector, is widespread.

The Jassid, *Rhopalogonia scita* (Wlk.), which appears to be unknown as a pest elsewhere, has been found on sugar-cane in numerous localities, but severe outbreaks seem to occur only at heights of about 4,000 ft. or more. All stages are present on the leaves of sugar-cane, maize and certain wild grasses. Heavy outbreaks of the Delphacid, *Saccharosydne saccharivora* (Westw.), occur annually in Carabobo and a few other places, but do not cause serious damage as they are rapidly controlled by predators, particularly Coccinellid and Chrysopid larvae, and the plants soon recover.

Cercopids have recently become major pests of sugar-cane in Venezuela, the most important and widely distributed of them being *Aeneolamia varia sontica* Fennah. Others that may sometimes be of local importance include seven of the other subspecies of *A. varia* recorded by Fennah [**40** 388], a list of which is given, *A. flavilatera* subsp. [*caripensis* Fennah] and *Delassor tristis monagasi* Fennah.

JENSEN (D. D.). **Notes on the Life History and Ecology of Blossom Midge,** *Contarinia lycopersici* **Felt (Diptera : Cecidomyiidae).**—*Proc. Hawaii. ent. Soc.* **14** no. 1 pp. 91–100, 7 refs. Honolulu, 1950.

Investigations were carried out in Hawaii in 1944–46 on the bionomics of *Contarinia lycopersici* Felt [*cf. R.A.E.*, A **37** 81] on tomato. It was found that the eggs are laid in masses in the androecium of the flower buds and that the larvae hatch and become full-fed within 5–7 days. When mature, or earlier if the flower becomes dry or otherwise unsuitable, they drop to the ground and enter the soil, where they pupate. The adults normally emerge after 12–15 days, but the larvae sometimes remain in the soil for some time before pupating, possibly owing to inadequate soil moisture or their own immaturity, and adults developing from such larvae tend to emerge later and are smaller than others. Caged adults survived for not more than four days. Each female probably oviposits in more than one bud ; in large numbers of infested buds examined, the numbers of eggs per bud were 1–37 and the numbers of larvae 1–44.

When vials containing moist soil into which larvae had burrowed were kept at 50°F. for various periods after 8–12 days at normal room temperature and were then returned to the latter, larvae that had not already pupated survived exposure to the low temperature and dehydration of the soil for periods of 6–26 days, pupated when removed from the cold and gave rise to adults 2–6 weeks later, whereas pupae that would have transformed to adults in two more days at room temperature survived exposure to cold for ten days but not for 26.

A commercial variety of tomato was found to have 50 per cent. of the buds and blossoms infested by larvae or eggs when a wild-type tomato, *Lycopersicum peruvianum*, growing in adjacent rows had only 6 per cent., the difference being apparently due to the fact that in *L. peruvianum*, the petal tips fit tightly into the distal end of the androecium of the young buds and prevent oviposition. Treatment with a spray of 1 lb. 20 per cent. wettable DDT per 100 U.S. gals. or 1 or 2 per cent. DDT dust protected tomato plants from oviposition, but did not prevent hatching of the eggs already laid or the development of the larvae inside the buds.

LANGE jr. (W. H.). **The Biology of the Mariana Coconut Beetle,** *Brontispa mariana* **Spaeth, on Saipan, and the Introduction of Parasites from Malaya and Java for its Control.**—*Proc. Hawaii. ent. Soc.* **14** no. 1 pp. 143–162, 4 figs., 26 refs. Honolulu, 1950.

The author describes all stages of *Brontispa mariana* Spaeth, reviews its synonymy and food-plants and discusses the distribution of the genus and of this and other species of it in Micronesia [*cf. R.A.E.*, A **39** 442 ; **40** 96]. Both larvae and adults of this Hispid feed in the buds of coconut, scraping off the surface of the leaves, and they are serious pests on Saipan and Rota (Mariana Islands). The eggs are laid between the folded leaflets in the buds, singly or end to end in groups of 2–6. In the laboratory on Saipan, the egg, larval and pupal stages and complete development lasted about 6, 23, 3–6 and 30–36 days at a mean temperature of 85°F. The adults survived for several months, and two females laid 113 eggs in 60 days and 106 in 33 days, respectively. Males and females were about equal in numbers. The generations overlapped, and the laboratory results indicated that there might be 3–9 in the year in the field. Both larvae and adults were positively thigmotropic and, under most conditions, negatively phototropic and tended to congregate at the bases of the leaves in large numbers. Infestation caused a slow decline of the trees, resulting in a reduction in yield and occasionally in death. The only other primary pest observed causing noticeable injury was the Coccid, *Furcaspis oceanica* Ldgr. [*cf.* **40** 96].

The natural enemies of Hispids that feed externally are reviewed, and a search for parasites in the Philippines, Malaya and Java is described. This resulted in the introduction into Saipan and Rota of *Tetrastichus brontispae* (Ferrière) and *Haeckeliania brontispae* Ferrière from both Malaya and Java [*cf.* **40** 96]. *T. brontispae* was parasitising 60 per cent. of the larvae and pupae of *B. mariana* on Saipan by November 1948. Other parasites collected in Malaya were *Achrysocharis* sp. from larvae of *Wallaceana palmarum* (Gestro) and *Plesispa nipae* Maulik, *Tetrastichus* sp. from pupae of *P. nipae*, and *Ooencyrtus podontiae* (Gah.) from the eggs of *P. reichei* Chapuis.

MARUCCI (P. E.) & CLANCY (D. W.). **The artificial Culture of Fruit Flies and their Parasites.**—*Proc. Hawaii. ent. Soc.* **14** no. 1 pp. 163–166, 1 ref. Honolulu, 1950.

An account is given of experiments on the culture of fruit-flies, chiefly *Dacus ferrugineus* var. *dorsalis* Hend., and their parasites on agar media. Attempts to induce females of *D. f. dorsalis* to oviposit directly on the media were largely unsuccessful and resulted in the inhibition of larval development by undesirable moulds introduced with the adults. In later tests, eggs or newly hatched larvae were transferred to the media with a camel's-hair brush. Eggs were obtained from sections of orange peel exposed to females in cages, and when larvae were desired, the eggs were kept on moist blotting paper until they hatched. The larvae were then reared in petri dishes containing about half an inch of the agar medium. When the larvae were ready to pupate, the dishes were opened and placed at an angle over moist sand, which was sieved at intervals to obtain the puparia formed in it. It was also found that the agar media could be poured on to sections of hardware cloth with a quarter-inch mesh, which allowed the mature larvae to fall directly on to the sand.

Tests of a standard agar formula, consisting of 760 cc. water, 20 gm. bacto-agar, 220 cc. banana pulp, 30 gm. dried yeast, and 20 gm. sucrose, with 3 cc. propionic acid and 2·4 cc. (0·18 per cent.) Moldex as mould inhibitors, all boiled for three minutes, and 14 variations of it containing substitutes for the banana, different amounts of agar and different quantities of yeast, sucrose and mould inhibitors or none, showed that the larvae developed and pupated normally and gave rise to normal adults with a high survival rate on the standard agar ; that yeast was essential for larval development ; and that the protein furnished by dead yeasts was adequate for larval nutrition. It appears likely, therefore, that in nature, fruits are merely the substrata for yeasts and other micro-organisms, from which the larvae derive most of their nourishment. The optimum concentration of larvae in the dishes was found to be about 2–4 per gm. medium. Larvae of *D. cucurbitae* Coq. and *Ceratitis capitata* (Wied.) were reared with equal facility on the same media, including that containing only yeast, agar and water.

In attempts to propagate *Opius longicaudatus* (Ashm.) on larvae of *D. f. dorsalis* in agar-base media, adult parasites were confined for varying periods in cages over the culture dishes, the medium being a firm agar (3 per cent.) covered with cheesecloth, through which the parasites oviposited. The cultures were unattractive to adults less than six days old, but older females oviposited readily and caused a high degree of parasitism, though the progeny were predominantly males. No female progeny were obtained from parasites more than ten days old. Fruit juices and extracts and 0·5 per cent. pyridine on the cheesecloth did not increase the attractiveness of the cultures or the degree of parasitism. Parasitism was at least as high among larvae in the first instar as among those in the second and third, and a higher proportion of females was produced in the smaller host individuals. *O. longicaudatus* also parasitised larvae of *C. capitata* in agar media, and a species of *Trybliographa* from Malaya

and *Tetrastichus dacicida* Silv. from Africa were both readily propagated on *D. f. dorsalis* and *C. capitata* ; larvae of *D. cucurbitae* were attacked equally readily, but no progeny were obtained.

PLANK (H. K.). **Life History, Habits, and Control of the Coconut Rhinoceros Beetle in Puerto Rico.**—*Bull. fed.* [*agric.*] *Exp. Sta. P.R.* no. 45, 35 pp., 12 figs., 24 refs. Mayaguez, P.R., 1948.

The following is based on the author's summary. *Strategus quadrifoveatus* (P. de B.) has been recognised as a serious pest of young coconut and other palms in Porto Rico for many years [*cf. R.A.E.*, A **25** 409]. The hurricanes of 1928 and 1932 blew down more than half of the bearing palms in many parts of the island, and some years later, the beetles that developed from eggs deposited in the decaying trunks killed about half the palms that had been replanted.

Observations on the bionomics of the Dynastid begun in 1935 showed that the eggs are deposited in decayed wood and hatch in about 17 days. The larvae become full-fed in about 14 months ; they normally feed in decaying coconut wood, but can develop in the wood of a number of other plants, or occasionally in coconut husks [*cf.* **9** 573]. The prepupal and pupal stages are spent in a cell formed by the larva in the wood in which it has developed and lasted 18 and 33 days, respectively. The adults move to young coconut palms soon after emergence to feed and mate and back to decayed wood later to oviposit. When very numerous, they sometimes attack palms of other species and the tops of bearing coconut palms, and may also hollow out sugar-cane stalks. Although nocturnal, they are only slightly attracted to lights. Total development and the life-cycle from egg to egg averaged 496 and 595 days, respectively. All stages but the egg were found in the field or obtained in the laboratory in every month of the year. Eggs and adults were most numerous in June and July and pupae in May ; larvae in the early instars predominated during the summer months and those in the last instar during the winter.

No internal parasites were found attacking any stage of *S. quadrifoveatus*, but the fungus, *Metarrhizium anisopliae* occurred on a few field-collected larvae. Larvae of *Pyrophorus luminosus* (Ill.) and adults of *Plaesius javanus* Erichson, which are both predacious on the larvae of other insects, fed avidly on the *Strategus* larvae in the laboratory. Methods of control are reviewed [*cf.* **9** 573 ; **25** 409 ; **29** 472]. Grove sanitation is desirable under all conditions, but particularly where large areas are planted for the first time or replanted after extensive wind damage. Planting in August and September was shown to minimise attack and to provide the most favourable growing conditions for the young palms. Three Malay varieties of dwarf coconuts were attacked less than native seedlings, but the numbers available for comparison were small.

PLANK (H. K.) & WINTERS (H. F.). **Insect and other Animal Pests of *Cinchona* and their Control in Puerto Rico.**—*Bull. fed.* [*agric.*] *Exp. Sta. P.R.* no. 46, 16 pp., 5 figs., 16 refs. Mayaguez, P.R., 1949.

In Porto Rico, *Cinchona* has been extensively cultivated at Maricao since 1935 and at Toro Negro since 1943, and notes are given in this bulletin on the pests observed attacking it. *Scirtothrips longipennis* (Bagn.) and *Anaphothrips orchidii* (Moult.), which feed on the leaves, were the most injurious. The former was usually the more abundant, but both generally attacked only small or medium-sized plants and were found in the greenhouse at Mayaguez and in the nurseries at Maricao and Toro Negro [*cf. R.A.E.*, A **34** 218 ; **36** 53]. Infestation was heaviest on plants that were short of water, and was more

severe on tall spindly plants than on short stocky ones. Other thrips that damaged the leaves were *Heliothrips haemorrhoidalis* (Bch.), *Tryphactothrips angulatus* (Hood) and *Dinurothrips hookeri* Hood. The predacious thrips, *Franklinothrips vespiformis* (Crwf.), was usually present in small numbers wherever *Scirtothrips* and *Anaphothrips* were abundant. At Toro Negro, a spray of 4 lb. 25 per cent. wettable DDT per 100 U.S. gals. gave 80 per cent. control of thrips after one application and did not damage trees four years old. It also caused no injury to seedlings two years old in nursery beds when applied three times at intervals of two weeks, but was harmful to younger seedlings and rooted cuttings.

Coccus viridis (Green) (which was attacked by a fungus, probably *Hypocrella* sp.) and the other Coccids, *Howardia biclavis* (Comst.), *Saissetia coffeae* (Wlk.) (*hemisphaerica* (Targ.)) and *Pseudaulacaspis pentagona* (Targ.), sometimes caused considerable damage [*cf.* **32** 346], but were satisfactorily controlled by sprays of 1 per cent. light-oil emulsion containing nicotine sulphate (1 : 800). *C. acuminatus* (Sign.) (which was also attacked by the fungus), *Ceroplastes cirripediformis* Comst., and *Planococcus* (*Pseudococcus*) *citri* (Risso) were observed occasionally at Toro Negro or Mayaguez, but were of minor importance, as also were the Aphids, *Myzus circumflexus* (Buckt.) and *Toxoptera aurantii* (Boy.) [*cf.* **36** 53], and an unidentified Psyllid near *Arytaina cayeyensis* Caldwell, from which *Alloxysta* sp. and *Discodes* sp. were reared. Larvae of the Geometrid, *Microgonia vesulia* var. *olivacea* Warren, and the Sphingid, *Xylophanes pluto* (F.), were found feeding extensively on the leaves at Toro Negro in August and at Maricao in May–December, respectively, but were controlled by hand-picking. Feeding by larvae of the Hesperiid, *Choranthus vitellius* (F.), caused insignificant injury and may have been accidental.

In the greenhouse, *Periplaneta americana* (L.) destroyed the freshly sown seed, but protection was afforded by placing cardboard tubes with phosphorus paste smeared on the inside about the beds. Nymphs of the Gryllids, *Anurogryllus muticus* (Deg.) and *Amphiacusta caraibea* Sauss., damaged the leaves of cuttings and potted plants and were controlled by hand collection and by the use of the baits of phosphorus paste, respectively. Various Phasmids fed on the leaves at Toro Negro, and the Tettigoniid, *Microcentrum triangulatum* Brunner, caused a little damage in October, but all were controlled by hand collection. Two unidentified species of *Tetranychus* injured and sometimes killed small seedlings in the greenhouse, but were controlled by treatment with dusting sulphur.

PLANK (H. K.). **Biology of the Bamboo Powder-post Beetle in Puerto Rico.**—*Bull. fed.* [*agric.*] *Exp. Sta. P.R.* no. 44, 29 pp., 19 figs., 13 refs. Mayaguez, P.R., 1948. **Studies of Factors influencing Attack and Control of the Bamboo Powder-post Beetle.**—*Op. cit.* no. 48, 39 pp., 9 figs., 26 refs. 1950.

Some of the information in the first of these papers from Porto Rico has already been noticed [*cf. R.A.E.*, A **32** 344]. It is further reported that adults of the Bostrychid, *Dinoderus minutus* (F.), enter bamboo at a break in the rind or at the leaf-sheath scars about the nodes and buds, often within 24 hours after the harvested culms are assembled for drying or storage. Growing plants are never attacked, and dead and dying culms left in clumps in the field only rarely. In laboratory studies, the egg stage lasted 3–7 days. Larvae reared in small pieces of bamboo fed for 41 days, pupated in cells at the end of their mines, and gave rise to adults about four days later. The adults left the cells after about three days. Recently emerged females collected in the field deposited an average of 110 eggs in 41 days, the maximum per female in one day being 11. Eggs laid by unfertilised females did not hatch.

The larvae and pupae are parasitised by the Braconid, *Doryctes parvus* Mues. [*cf.* **30** 362], and the Pteromalid, *Proamotura aquila* Gir., respectively, and the predacious Reduviid, *Peregrinator biannulipes* (Montr. & Sign.) attacks the adults. None of them appeared to reduce populations before considerable damage had been done. Other casual predators of the adults, eggs or larvae are recorded.

Much of the information in the second paper, in which investigations on the factors that influence the susceptibility of harvested bamboo to attack by *D. minutus* and measures that might be used to reduce or prevent damage are described, has also been noticed [*cf.* **32** 344–345 ; **34** 219 ; **36** 54, 55 ; **38** 369]. It was found that much damage could be avoided by harvesting culms of *Dendrocalamus strictus* and *Sinocalamus oldhami* during their first three years of growth, those of *Bambusa tulda* and *B. tuldoides* in the second year or later and those of *B. vulgaris* in the third year or later. Harvesting in August–December resulted in less infestation than harvesting in February–May. Clump-curing in the field [*cf.* **32** 344] gave up to 90 per cent. control of infestation, and the best results were obtained during moist hot weather, when the culms could be kept alive for a month or more, thus increasing starch depletion. Storing the culms in a shed for at least eight weeks after they have been clump-cured made them even less susceptible to infestation. Soaking the freshly harvested culms in a fresh-water pond for eight weeks reduced infestation by 94 per cent., but stained the wood and made it light and brittle. Complete submersion for 12 weeks did not protect culms of a thin-walled variety of *B. arundinacea*. Clump-curing followed by submersion gave some control but was less effective than clump-curing followed by shed-curing. Injecting copper sulphate by the stepping method [*cf.* **28** 494] gave an average of 93 per cent. control and proved more effective during late winter and spring, when the days were bright and windy with little rainfall, than duringwet weather, because of more rapid and thorough absorption. Hydrochloric acid applied in the same way failed to hydrolyse the starch in the culms and seriously reduced the strength of the wood [*cf.* **32** 344], and 2,4-D (2,4-dichlorophenoxyacetic acid) (1 : 500) and indolebutyric and indoleacetic acids, applied by internodal injection, also failed to reduce the concentration of starch in the wood. It is considered that substances that induce flowering should be investigated, as culms that have matured seed are known to be free of starch. Sections of *B. tulda* and *B. vulgaris* that were impregnated with liquid bakelite under pressure showed changes in wood character when the bakelite solidified. Although the pores were not entirely closed or the reaction to iodine materially modified, the treatment hardened the wood and protected it from attack during four years of constant exposure. DDT gave very effective control in dips [*cf.* **38** 369], and water suspensions should be used where oil solutions may cause difficulty in gluing. Strict sanitation methods should be followed to reduce the beetle population, and wettable DDT should be liberally sprayed or brushed on curing racks, the insides of curing sheds and workrooms, and wherever bamboo articles are stored.

PLANK (H. K.). **Insecticidal Properties of some Plants growing in Puerto Rico.**—*Bull. fed.* [*agric.*] *Exp. Sta. P.R.* no. 49, 17 pp., 22 refs. Mayaguez, P.R., 1950.

The following is virtually the author's summary. Results are given of laboratory " screening " tests in Porto Rico of up to nine different parts of 48 species of plants in 23 families Three or more local economic representatives of four orders were used as test insects. One or more parts of 22 species of plants in 13 families showed moderate to high toxicity, and all tested parts of 26 species in 15 families were inert or weakly toxic. Six out of 11 species of Fabaceae, the largest family tested, and one out of four species of Clusiaceae,

the next largest, were found to be toxic. Systematic position, or the fact that a given plant was poisonous to other animals or was a common weed rarely attacked by insects, was not a positive indication of insecticidal properties.

The half-ripe fruits, mature seeds, and leaves of *Mammea americana* (mamey) and the seeds of some introductions of *Pachyrhizus erosus* (yam bean) showed definite insecticidal value. Mamey, with a minimum of elaboration, offers an effective and economical means of control of some insects by farmers and others having access to fresh material. Yam-bean seed, which contains rotenone and other toxic compounds, can be more widely grown, but it was very oily and required more preparation than mamey and, in these tests, was not so effective against the same species of insects. The roots of two species of *Piscidia* also showed insecticidal possibilities, but need more extensive tests before they can be definitely evaluated.

[Chernoponevkina (S. M.).] **Чернопоневкина (С. М.). A new Pest—a Geometrid of the Genus *Phasiane*—and its Control.** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **13** no. 7 pp. 37–39, 8 refs. Moscow, 1948.

During investigations on pests of lucerne in the Province of Kursk, central Russia, in 1946–47, larvae of an unidentified Geometrid of the genus *Phasiane* were observed causing serious damage by feeding on the leaves and flowers. All stages are briefly described. There were two generations a year, the pupae of the second overwintering. Adults were present from mid-May to the end of June and again from early July until mid-August. Oviposition began 2–3 days after emergence, and the females, which survived for 11–26 days, laid an average of 290 eggs each on the leaves of lucerne or weeds. The egg stage lasted 9–14 days at 12–18·6°C. [53·6–65·48°F.] and 6 days at 19–23°C. [66·2–73·4°F.], the larval stage 28–39 days at mean temperatures of 15–25°C. [59–77°F.] and the pupal stage, which is passed in the soil, 10–14 days at 19·5–22·5°C. [67·1–72·5°F.]. Larvae were observed on lucerne until mid-September. Fermenting molasses in pans placed in fields of flowering lucerne proved an effective bait for the adults, and in tests of sprays against the larvae in 1943 and 1944, paris green at 3 lb. with 9 lb. molasses per 100 gals. gave about 90 per cent. mortality in five days and was more effective than several other stomach insecticides tested.

[Selivanova (S. N.).] **Селиванова (С. Н.). Parasites of the Millet Midge (*Stenodiplosis panici* Rod.).** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **13** no. 11 pp. 23–26, 1 fig. Moscow, 1948.

Stenodiplosis panici Plotnikov became numerous on millet [*Panicum miliaceum*] in the Province of Voronezh, central Russia, in 1943 [*cf. R.A.E.*, A **35** 346]. No parasites had been recorded from it, but in the spring of 1946, the Miscogasterid, *Systasis encyrtoides* Wlk., and a Scelionid described from the adult female as *Inostemma panici*, sp. n., were reared from overwintered larvae in the husks. The percentage of parasitism by *Inostemma* was 23·7. Males are unknown. Females were observed in millet fields in the summer, but not in fields of other cereals, and were present in considerable numbers between 12th and 30th August; 54 per cent. of the larvae overwintering in their cocoons were parasitised late in the following autumn, and up to 12 parasite larvae were observed in a single host. They hibernated in the body cavity. Development was resumed in spring, and usually only the largest larva survived. It pupated in a cocoon inside the integument of the host. The diapause of the host and parasite was not of long duration and was terminated by exposure to temperatures above 16°C. [60·8°F.] in a moist environment. The development of *Inostemma* was slower than that of the host; larvae of *Stenodiplosis* kept

from the beginning of October at 20°C. [68°F.] pupated in 25 days and the first adults emerged 31 days after the beginning of the experiment, whereas the corresponding periods for *Inostemma* were 38 and 50 days. Temperatures of 17–22°C. [62·6–71·6°F.] were the most favourable for both host and parasite, larval mortality then being at a minimum. Maximum emergence of the parasite occurred at 22°C. Development ceased at temperatures below 16°C. and was retarded at 17°C. High temperatures were detrimental, the percentage adult emergence being only 10 and 5 at 30 and 37°C. [86 and 98·6°F.], respectively.

[Kalandadze (L. P.) & Dzhashi (V. S.).] **Каландадзе (Л. П.) и Джаши (В. С.). The polyphagous Leaf-roller (*Tortrix* (*Eulia*) *politana* Haworth)—a Pest of the Tea Bush.** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **14** no. 9 pp. 3–7, 5 figs., 4 refs. Moscow, 1949.

The authors give a list of the insect pests of tea in Transcaucasia and an account of investigations in the laboratory and in the field near Batum on the bionomics of *Eulia* (*Tortrix*) *politana* (Haw.), a polyphagous Tortricid that was observed attacking the plant for the first time in 1948. All stages are described. The damage caused resembled that by *Sparganothis pilleriana* (Schiff.), the larvae feeding on the leaves and buds and cutting off the shoots. In the laboratory, the larvae destroyed about 100 leaves and 50 buds each during their development, and some bushes in the field were almost entirely defoliated, especially after pruning. Heavy infestation causes up to 50 per cent. reduction in yield. The older larvae roll the leaves and web them together, and pupation occurs in the rolled leaves. There were three complete generations a year, as compared with one of *Sparganothis*, and hibernation occurred in the pupal stage. Adults of the overwintered generation were present in April–May, larvae of the first generation were in the third and fourth instars in early June and pupated at the end of the month, and the adults emerged after 7–10 days and were numerous for a week in the first half of July. In the laboratory, at 22–26°C. [71·6–78·8°F.] and a relative humidity of 70–80 per cent., the males survived for 5–7 days and the females for up to 9 days. The eggs were laid in batches averaging 60–80 on the upper surface of the coarser leaves and hatched in 8–12 days. The larvae became full-fed in 30–40 days, and gave rise to adults in September. Larvae of the third generation pupated at the beginning of December. No parasites or predators were observed.

[Fedotov (D. M.).] **Федотов (Д. М.). The Method of Forecasting the Abundance of the Noxious Little Tortoise by its internal Condition.** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **14** no. 9 pp. 8–15, 6 figs., 5 refs. Moscow, 1949.

In the course of investigations by the author in 1941–45 on the possibility of controlling *Eurygaster integriceps* Put. [*cf. R.A.E.*, A **40** 308, etc.], it was found that the functioning of the internal organs of the adults was not the same during periods of mass increase as in periods of decline, and that by examining these organs, forecasts could be made of the approach of an increase or a reduction in population. A knowledge of the internal development of the bugs and of the changes that take place in the condition and functioning of the organs is essential, and information is therefore given on the method of dissecting the bugs and on their internal condition at various stages of their seasonal activity, including early summer, when the young adults are about to leave the grain fields for their aestivation quarters, the aestivation period itself, the period of autumn activity, hibernation, and the active period of the overwintered adults in spring. The condition of the young and old adults during a period of numeric decrease is also discussed with a view to forecasting the probability of an increase in abundance.

[Galakhov (P. N.).] **Галахов (П. Н.). The Dynamics of the seasonal Migration of the Larvae of *Agriotes gurgistanus* Fald. in the Soil and the Effectiveness of various Control Measures against them.** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **15** no. 1 pp. 31–35, 10 refs. Moscow, 1950.

Larvae of *Agriotes gurgistanus* (Fald.) cause severe damage to groundnuts in the Soviet Union, and investigations on their seasonal migrations in the soil and methods of controlling them were carried out at Krasnodar, North Caucasus. Examination of soil samples showed that the larvae moved towards the surface in spring when the temperature of the surrounding soil approached 10°C. [50°F.] and congregated in the upper layers when the temperature at a depth of 4 ins. reached 15°C. [59°F.]. In summer, when the soil temperature was over 24°C. [75·2°F.] and its humidity dropped to 20 per cent., they congregated round the plants and fed on the pods. After harvest, they moved to the lower layers for hibernation.

Preliminary tests on control were carried out in the laboratory. Various poisoned baits proved ineffective, and DDT applied at about 95 lb. per acre in a 5 per cent. dust to soil in pots gave no mortality, but BHC (benzene hexachloride) at 4·5, 9, 18 and 27 lb. per acre in a 7 per cent. dust killed 67, 80, 87 and 100 per cent. of the larvae, respectively, in a month. In field tests, in which the BHC dust was broadcast and then worked into the soil with a cultivator to a depth of 4 ins., BHC at 9 and 18 lb. per acre gave 69 and 100 per cent. mortality in a month, and it was found that working the dust in with a cultivator was more effective than harrowing. In a further test, BHC retained its effectiveness in the soil for at least 50 days. Dusting the seed with 1 per cent. DDT or BHC before planting afforded no protection.

Münster (J.). **Considérations sur l'évolution des pucerons vecteurs des maladies à virus de la pomme de terre. Résultats des dénombrements de 1950 comparés à ceux des années précédentes.**—*Landw. Jb. Schweiz* **65** pt. 5–6 pp. 443–460, 7 graphs, 14 refs. Berne, 1951. (With a Summary in German.)

The investigations on the suitability of various districts in Switzerland for the production of virus-free seed potatoes, begun in the Cantons of Vaud, Fribourg and Valais in 1945 [*cf. R.A.E.*, A **38** 392] were continued in 1948–50, when they were extended to Berne and Neuchâtel. Counts of Aphids were made as before [*loc. cit.*] ; the results for the three years are shown on graphs, and those for 1950 are discussed in detail. The Aphids observed in that year were again mainly *Myzus persicae* (Sulz.), *Macrosiphum solanifolii* (Ashm.) and *Aphis* (*Doralis*) *rhamni* Boy. Their relative frequency varied with locality, and each species predominated in particular districts. *M. solani* (Kalt.) (*Aulacorthum pseudosolani* (Theo.)) was common only at the beginning of the season, and *Rhopalosiphoninus latysiphon* (Davidson) was not observed in the field, though it was the most numerous Aphid on stored tubers [*cf.* **37** 64].

Aphids were first found on potato in the field at the end of May. The population reached a peak early in July, then decreased slightly owing to the dry weather, which reduced the turgescence of the leaves, and rose to a second peak at the end of the month. Although the later varieties of potato were still growing vigorously, there was a steady decline in numbers in August, and this is attributed mainly to bad weather. By the end of September or early October, the Aphids had practically disappeared from the crop.

When the results of the counts were divided into three groups corresponding to altitudes of about 1,250–1,900, 1,950–2,750 and 3,250–3,900 ft., it was found that few Aphids occurred at the highest range in any of the years. Aphids were equally numerous in the two lower ranges in 1948 and 1950, but the peak of infestation came three weeks later at the medium altitude in 1948, and six

weeks later in 1950, as compared with the lowest one. In 1949, which was exceptionally favourable for Aphids, the peaks for these two lower altitude ranges occurred at the end of July, the counts reaching 800 and 460 per 100 leaves, respectively. There were many local exceptions to the general trend for infestation to decrease as altitude increased, and it was sometimes higher at higher elevations than at lower ones.

The results of the counts for 1950 were analysed with respect to the prospects of virus diseases occurring in the 1951 crop, and it is concluded that infection was likely to be diminished in most cases. As the Aphids are not equally efficient vectors of potato viruses, their relative frequency is of importance. *A. rhamni* normally transmits only viruses Y and A, but the apterae of this species are very lethargic and it is not an important vector unless present in very large numbers. *Myzus persicae* is the chief virus vector and was present in about the same proportion in 1950 as in 1949. *Macrosiphum solanifolii* is chiefly of importance as a vector of leaf-roll. Transmission of this virus requires a long feeding period on a diseased plant, followed by a long period on a healthy one, and is mainly dependent on the older alates. Few winged forms survived for long under the weather conditions of 1950, and it was therefore probable that the 1951 crop would suffer from a greater percentage of viruses A and Y than from leaf-roll.

ZOGG (H.), HORBER (E.) & SALZMANN (R.). **Bericht über die Tätigkeit der Eidg. Landwirtschaftlichen Versuchsanstalt Zürich-Oerlikon pro 1948/49. 8. Pflanzenschutz.** [Report of the Federal Agricultural Experiment Station Zürich-Oerlikon for 1948–49. 8. Plant Protection.]—*Landw. Jb. Schweiz* **64** pt. 4–5 pp. 432–442, 2 figs. Berne, 1950. **Bericht über die Tätigkeit der Eidg. Landwirtschaftlichen Versuchsanstalt Zürich-Oerlikon pro 1949/50. 8. Pflanzenschutz.** [Report of the Federal Agricultural Experiment Station Zürich-Oerlikon for 1949–50. 8. Plant Protection.]—*Op. cit.* **65** pt. 5–6 pp. 511–531, 5 figs. 1951.

Notes are given as for previous years [*cf. R.A.E.*, A **39** 420, etc.] on pests and diseases of various crops in Switzerland and their control in the calendar years 1949 and 1950. Pests that were injurious in both years included *Mayetiola destructor* (Say) on wheat, *Oscinella frit* (L.) on rye in 1949 and oats and barley in 1950, *Pegomyia hyoscyami* (Panz.) on beet, *Psylliodes chrysocephala* (L.) on rape and *Tetranychus telarius* (L.) (*urticae* Koch) on hops. *Bruchus obtectus* Say (*Acanthoscelides obsoletus*, auct.) continued to increase on stored beans, and infestation in the field was confirmed [*cf.* **39** 420]. *Leptinotarsa decemlineata* (Say) caused little damage to potato in either year. In field tests of insecticides in 1949, a suspension of methoxy-DDT (methoxychlor) and an emulsified solution of DDT gave good results against larvae and adults of *L. decemlineata*, but emulsion sprays of parathion, chlordan or toxaphene and a parathion dust were ineffective at the concentrations used. In further tests in 1950, sprays of dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene] proved superior to DDT, and Potasan [4-methylumbelliferone O, O-diethyl thiophosphate] as a dust was useless. Aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene] gave promising results in sprays, and calcium arsenate was unsatisfactory in both years.

Various insecticides were applied to the soil in the two years against larvae of *Melolontha melolontha* (L.) and wireworms (*Agriotes* spp.). In tests on meadowland, the best results were obtained with chlordan emulsions applied in liquid manure, but broadcasting dry mixtures containing BHC (benzene hexachloride), chlordan or (in 1950) aldrin considerably reduced the numbers of both pests. BHC and chlordan broadcast in a potato field in 1949 protected high percentages of tubers from damage, but some tainting occurred, particularly in

the case of BHC. It is stated in the second report that the same two materials were also broadcast in November 1949 against *Hylastes* (*Hylastinus*) *obscurus* (Marsh.) on clover. In September 1950, the percentages of infested roots were 26 for no treatment, 11 for BHC and 6 for chlordan. Investigation in 1950 on the effectiveness of controlling the adults of *Melolontha* at the edges of woodland in reducing subsequent larval populations in neighbouring areas [*cf.* **40** 188] showed that the method was effective only where the treatment had been completed within about five days of the main flight to the trees. The same report also contains a brief account of investigations on *Chlorops pumilionis* (Bjerk.) on cereals already noticed [**40** 314].

KOTTE (W.). **Krankheiten und Schädlinge im Gemüsebau und ihre Bekämpfung.** [Diseases and Pests of Vegetables and their Control.]—2nd revd. edn., $9\frac{1}{4} \times 6\frac{1}{2}$ ins., [8+] 280 pp., 8 col. pls., 186 figs. Berlin, P. Parey, 1952. Price bound *DM.* 27 ; unbound *DM.* 24.

This second edition of a practical handbook on the pests and diseases of vegetables and their control in Germany resembles the first in scope and arrangement [*cf. R.A.E.*, A **35** 104], but the matter has been extended and brought up to date by the inclusion of more information on certain pests that have recently increased in importance, accounts of modern synthetic insecticides and spraying and dusting apparatus, and increased emphasis on forecasting outbreaks of pests.

FENTON (F. A.). **Field Crop Insects.**—$8\frac{1}{2} \times 5\frac{3}{4}$ ins., ix+405 pp., 224 figs., refs. New York, N.Y., Macmillan Co., 1952. Price $5.75.

This text-book on crop protection in the United States is based on a course on insect pests of field crops and stored grain for agricultural students. The first ten chapters are concerned with general principles and deal with the extent and evaluation of losses due to insect pests, the factors that affect insect abundance and distribution, the general life-history of insects, insecticides (including notes on the properties and uses of those most commonly used, types of formulation and legal requirements governing their sale and manufacture), the different methods of applying insecticides, types of equipment for their application, physical, cultural and biological control methods, and plant quarantines and large-scale control campaigns. The remaining seven chapters contain descriptions and information on the bionomics and control of particular insects and mites representative of those causing various types of plant injury, classified according to the method of attack or the part of the plant injured ; the species selected are usually of considerable economic significance, but some basic principles are illustrated by less important ones.

GRAHAM (S. A.). **Forest Entomology.**—3rd edn., $9\frac{1}{4} \times 6\frac{1}{4}$ ins., xii+351 pp., frontis., 85 figs., $21\frac{1}{2}$ pp. refs. New York, N.Y. & London, McGraw-Hill Book Co., Inc., 1952. Price $6 or 42*s.* 6*d.*

The general scope of this third edition of a text-book on forest entomology resembles that of the earlier ones [*R.A.E.*, A **17** 420 ; **27** 527], but the subject matter has been rearranged to some extent and much of it rewritten to keep abreast with the greatly increased knowledge of forest ecology and control measures ; the new material includes information based on the author's own observations and on unpublished reports of work in the United States and Canada. A few additional insects are mentioned, and the information on the bionomics of some species has been extended and brought up to date, but the sections most extensively revised are those on control by silvicultural methods, to which a complete chapter is devoted, and on biological and chemical control.

There are additional chapters on insecticides and their indirect effects, and on methods of detecting and assessing infestations. The chapter on insects as transporters of other insects and of disease organisms [**27** 527] has been omitted.

WAY (M. J.) & HOPKINS (B. A.). **The Influence of Photoperiod and Temperature on the Induction of Diapause in *Diataraxia oleracea* L. (Lepidoptera).**—*J. exp. Biol.* **27** no. 3–4 pp. 365–376, 5 graphs, 20 refs. London, 1950.

The following is largely the authors' summary. Laboratory investigations on the factors inducing diapause in the pupae of the tomato moth, *Diataraxia oleracea* (L.), in Britain showed that it is influenced by temperature and the duration of the daily exposure to light (photoperiod) during the larval stage [*cf. R.A.E.*, A **35** 54]. Low temperatures and short photoperiods tended to induce diapause, and high temperatures and long photoperiods tended to prevent it. Diapause was not influenced by light intensity during the larval stage provided that the intensity was above a certain minimum (less than 1 foot-candle). It was prevented at high temperatures (30–34°C. [86–93·2°F.]), even when the larvae were reared in darkness. The photoperiod was operative as a factor influencing diapause only between the beginning of the moulting sleep prior to ecdysis to the last instar and the first 3–5 days of the last instar. A single photoperiod of 16 hours during the moulting sleep is probably sufficient to prevent diapause. Diapause was not influenced by photoperiodically controlled substances in the food-plant.

NORRIS (M. J.) (Mrs. O. W. RICHARDS). **Reproduction in the Desert Locust (*Schistocerca gregaria* Forsk.) in Relation to Density and Phase.**—*Anti-Locust Bull.* no. 13, [4+] 49 pp., 8 figs., 18 refs. London, 1952.

The following is substantially the author's summary. Previous work on the effects of density on the reproduction of *Locusta migratoria migratorioides* (R. & F.) in the laboratory showed that, contrary to the usual assumption, both the fecundity and the rate of sexual maturation of adults reared in isolation or in crowds and subsequently kept as isolated pairs were greater than those of adults kept throughout their life under crowded conditions [*R.A.E.*, A **39** 137]. Similar experiments were carried out with *Schistocerca gregaria* (Forsk.), the reactions of which to density differed widely from those of *Locusta* and approached more nearly to conventional expectation.

The terms *solitaria* and *gregaria* are used in this account of the work to distinguish locusts reared in isolation and in crowds, respectively. The rate of sexual maturation was found to increase with adult density. The females in isolated pairs laid their first egg pods in an average of 38 days. The period required for maturation varied greatly, even among contemporary individuals kept under uniform conditions, but was not affected by their density as hoppers. During the first four weeks of adult life, the average number of pods laid per female was 0·4. When *gregaria* adults were kept in crowds of 30 pairs, the rate of maturation was much more uniform ; most of them laid their first pods during the third or fourth week after emergence, and by the end of the fourth week, the average number of pods laid per female was 1·2. Groups of five and ten pairs matured at an intermediate rate, the number of pods per female laid in four weeks being 0·8. When *solitaria* adults were kept crowded, they matured at the same rate as *gregaria* at the same density.

The effect of density on sexual maturation in *Schistocerca* is therefore the opposite of that in *Locusta*, in which *solitaria* and isolated *gregaria* mature much more rapidly than the crowded *gregaria* and show little variability. *Locusta* solitaries mature in an average of 10·6 days and lay an average of five pods in the first four weeks ; their rate is therefore very much higher than that of *Schistocerca* at any density. Gregarious *Locusta* in crowds of 30 pairs mature

only slightly more quickly than *Schistocerca* at the same density. The rate of oviposition of the mature females of the latter is about one pod per week and is unaffected by density. In *Locusta*, the *solitaria* and isolated *gregaria* oviposit more quickly than crowded *gregaria*.

No significant effects of density on fecundity or the viability of the eggs were demonstrated. The mean number of pods laid per female was 5·2 and the mean clutch (number of eggs per pod) was 61, giving a total mean fecundity of 317 eggs per female. Fecundity, although not increased by crowding, was not reduced as in *Locusta*, where the clutch was reduced by crowding during adult life and further reduced by crowding during hopper life, in so far as the weight of the females was affected. In *Schistocerca*, as in *Locusta*, female weight tended to be reduced by crowding, but no general correlation between weight and clutch was demonstrated.

Significant differences in the rate of sexual maturation and in clutch were shown to exist between the main laboratory stock of *Schistocerca* and a new stock obtained by crossing it with a recently imported stock. The wide variability in maturation time of isolated pairs is largely attributable to the varying periods required by the males to become sexually mature. No environmental factor determining this rate was detected, and it is thought that the differences observed in the laboratory were largely of hereditary origin. Under crowded conditions, many females may be fertilised by the earliest maturing males, and moreover maturation of males was actually accelerated by crowding. Maturation of males at low density or in isolated pairs was accelerated if a mature male was added. Moreover, if a male became mature in the presence of one mature male instead of one female, it assumed the yellow colour characteristic of mature males under crowded conditions. The nature of this " activation factor " was under investigation.

Papers noticed by Title only.

McBride (O. C.) & Tanada (Y.). **A revised List of Host Plants of the Melon Fly** [*Dacus cucurbitae* Coq.] **in Hawaii.**—*Proc. Hawaii. ent. Soc.* **13** no. 3 pp. 411–421, 36 refs. Honolulu, 1949.

Kraemer (G. D.). **Die Brutbaumdisposition bei Borkenkäferbefall. (Vorläufige Mitteilung.)** [The Condition of Trees attacked by Bark-beetles. (Preliminary Communication.)]—*Anz. Schädlingsk.* **22** pt. 4 pp. 49–51, 1 fig. Berlin, 1949. [For more detailed account see *R.A.E.*, A **40** 47.]

Choudhury (B.) & Robinson (V. B.). **Clinical and pathologic Effects produced in Goats by the Ingestion of toxic Amounts of Chlordan and Toxaphene.**—*Amer. J. vet. Res.* **11** no. 38 pp. 50–57, 3 figs., 22 refs. Chicago, Ill., 1950. [See *R.A.E.*, B **40** 200.]

Rosenberg (M. M.) & Adler (H. E.). **Comparative Toxicity of DDT and Chlordan to young Chicks.**—*Amer. J. vet. Res.* **11** no. 38 pp. 142–144, 9 refs. Chicago, Ill., 1950. [See *R.A.E.*, B **40** 200.]

Rosenberg (M. M.) & Tanaka (T.). **Toxicity of Chlordan to growing Chickens.**—*Amer. J. vet. Res.* **11** no. 39 pp. 233–235, 1 ref. Chicago, Ill., 1950. [See *R.A.E.*, B **40** 200.]

Rosenberg (M. M.), Tanaka (T.) & Adler (H. E.). **Toxicity of Chlordan to laying Pullets.**—*Amer. J. vet. Res.* **11** no. 39 pp. 236–239, 4 refs. Chicago, Ill., 1950. [See *R.A.E.*, B **40** 200.]